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Vol IV of V

Part 1 of 2



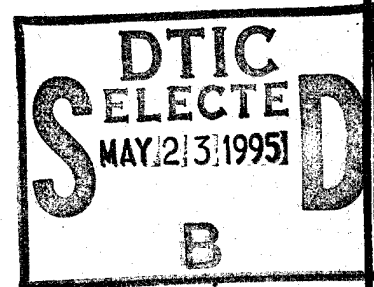
**AIR FORCE SITE CHARACTERIZATION AND ANALYSIS PENETROMETER SYSTEM (AFSCAPS): LASER-INDUCED FLUORESCENCE CONE PENETROMETER - CPT PROFILES, BORING LOGS AND DT&E PLANS
(VOL IV OF V - PART 1 OF 2)**

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December 1994

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Final Technical Report for Period March 1992 - November 1992

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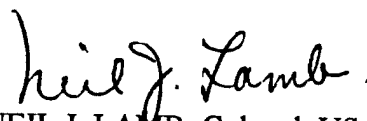
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19. ABSTRACT (Continue on reverse if necessary and identify by block number) A prototype Laser-Induced Fluorescence-Electric Cone Penetrometer Test (LIF-CPT) system was demonstrated at Tinker Air Force Base (Tinker AFB), Oklahoma as an innovative technology for delineating soil contamination resulting from fuel spills. Applied Research Associates, Inc. (ARA) and the North Dakota State University (NDSU) conducted the development program for the Air Force using LIF-CPT components developed within the Triservice Site Characterization and Analysis Penetrometer System (SCAPS) effort. Major components of the system consisted of ARA's cone penetrometer system coupled with NDSU's tunable laser fluorimeter. To enable rapid, efficient and minimally invasive site characterization, the LIF-CPT probe data output was linked to ARA's real-time analysis system with three-dimensional modeling and scientific visualization capabilities. Field testing at Tinker AFB was conducted to evaluate the LIF-CPT probe. During the testing program, 112 soundings at eight contaminated sites were conducted. At select locations, soil and water samples were obtained with CPT or drilling technologies, and tested using analytical procedures to confirm the presence of fuel contamination This volume presents the LIF-CPT profiles that were generated along with boring logs from the drilling program, gas chromatograph results from the field analytical testing, and the work plans for the demonstration program.					
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PREFACE

This report was prepared by Applied Research Associates, Inc. (ARA), Waterman Road, South Royalton, VT 05068, under contract FO8635-88-C-0067, SETA SSG Subtask 8.00, for the Air Force Civil Engineering Support Agency, Engineering and Services Laboratory, Tyndall Air Force Base, Florida 32403-6001. North Dakota State University was a subcontractor to ARA and fabricated and assisted in demonstrating the laser spectrometry technology.

This work was sponsored by the Oklahoma City Air Logistics Command, Directorate of Environmental Management (OC-ALC/EM) and the U.S. Air Force Civil Engineering Support Agency (AFCESA). Ms. Beverly Allen of OC-ALC/EM and Mr. Bruce Nielsen of AFCESA/RAVW were the Government technical program managers.

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APPENDIX A

LIF-CPT PROFILES FROM NORTH TANK AREA

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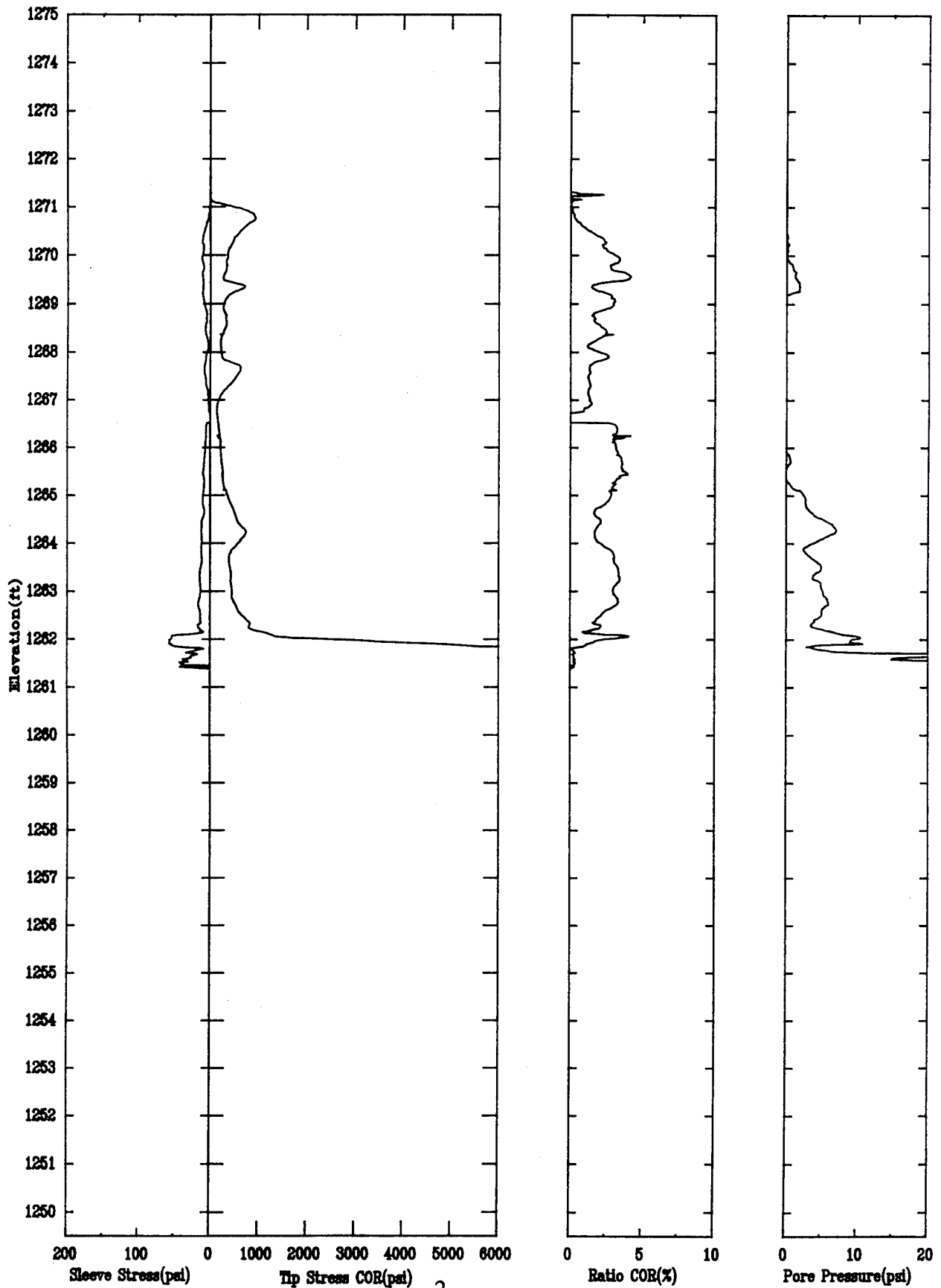
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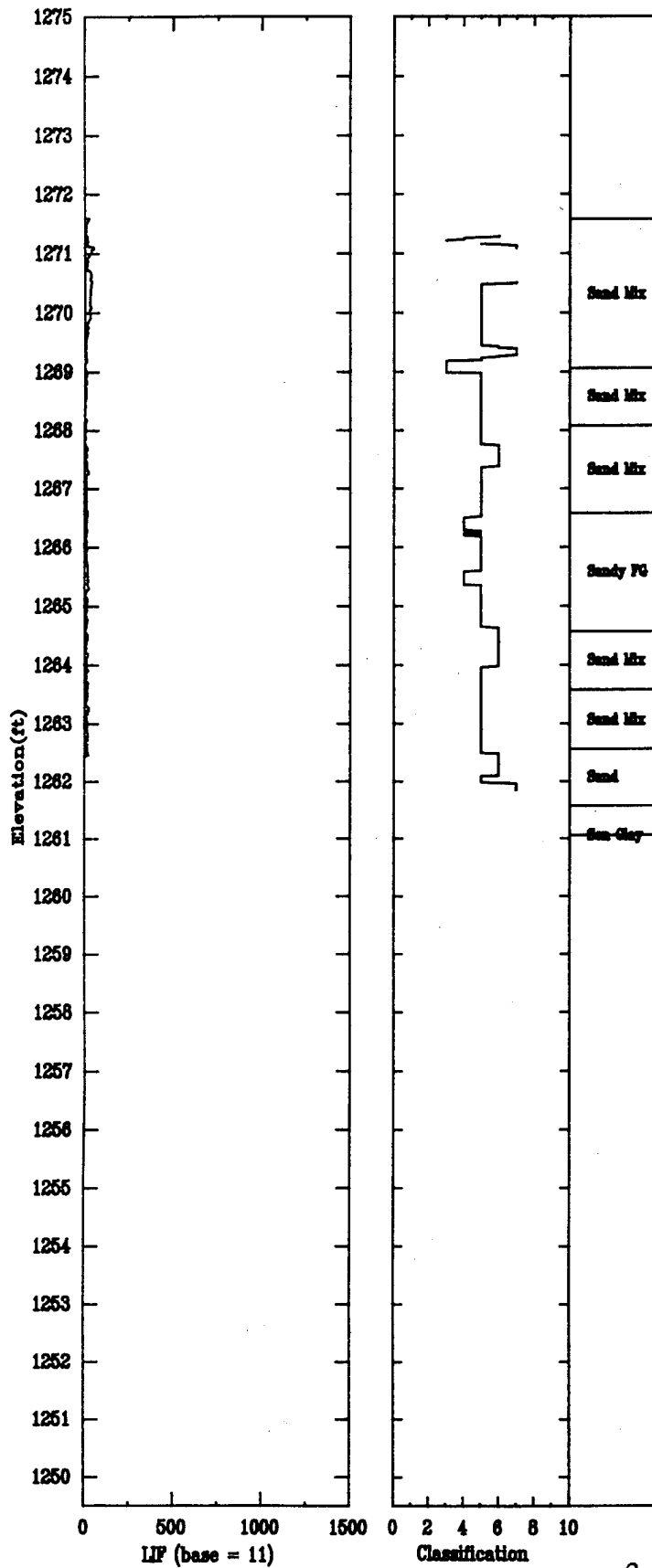
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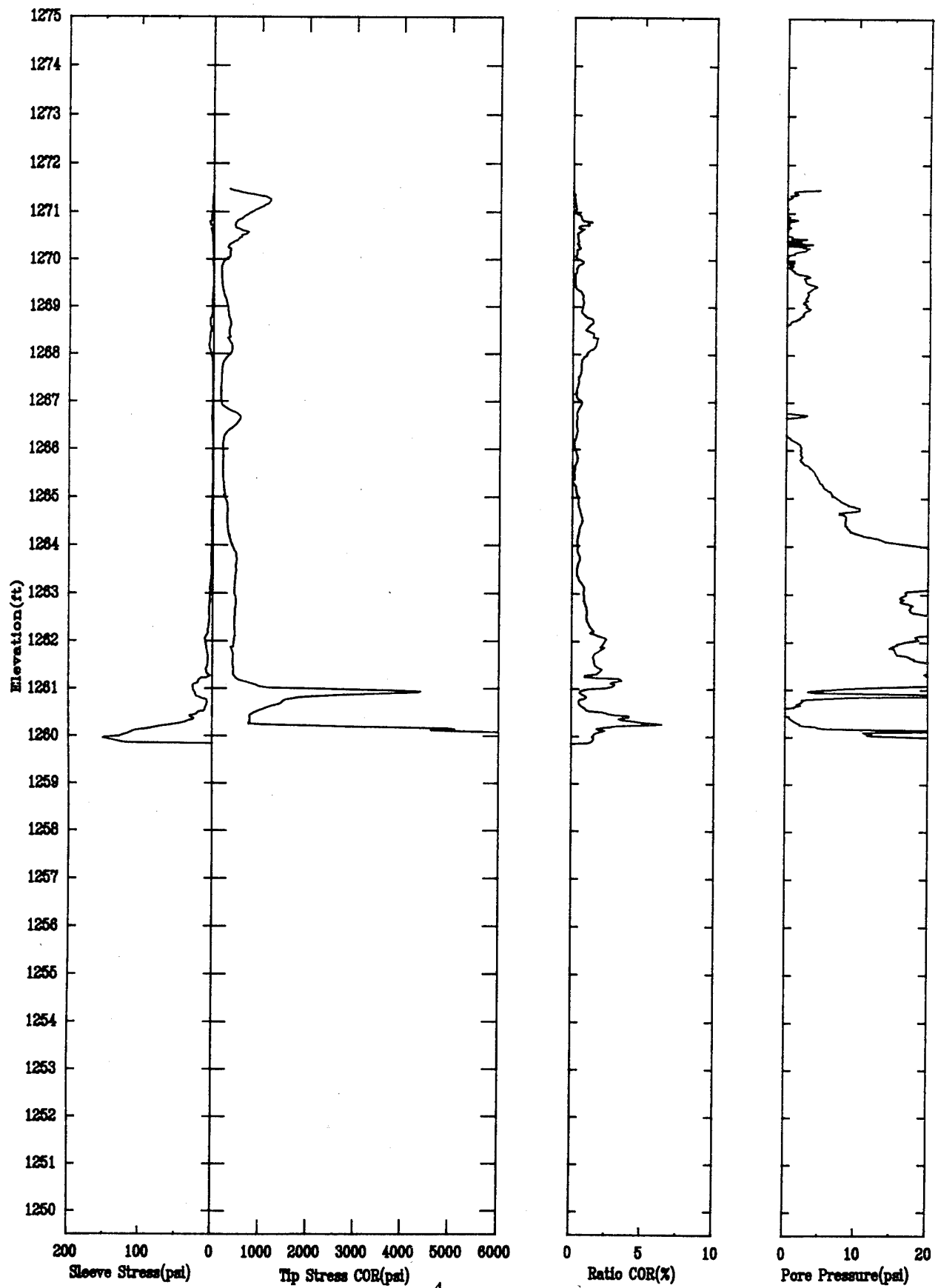
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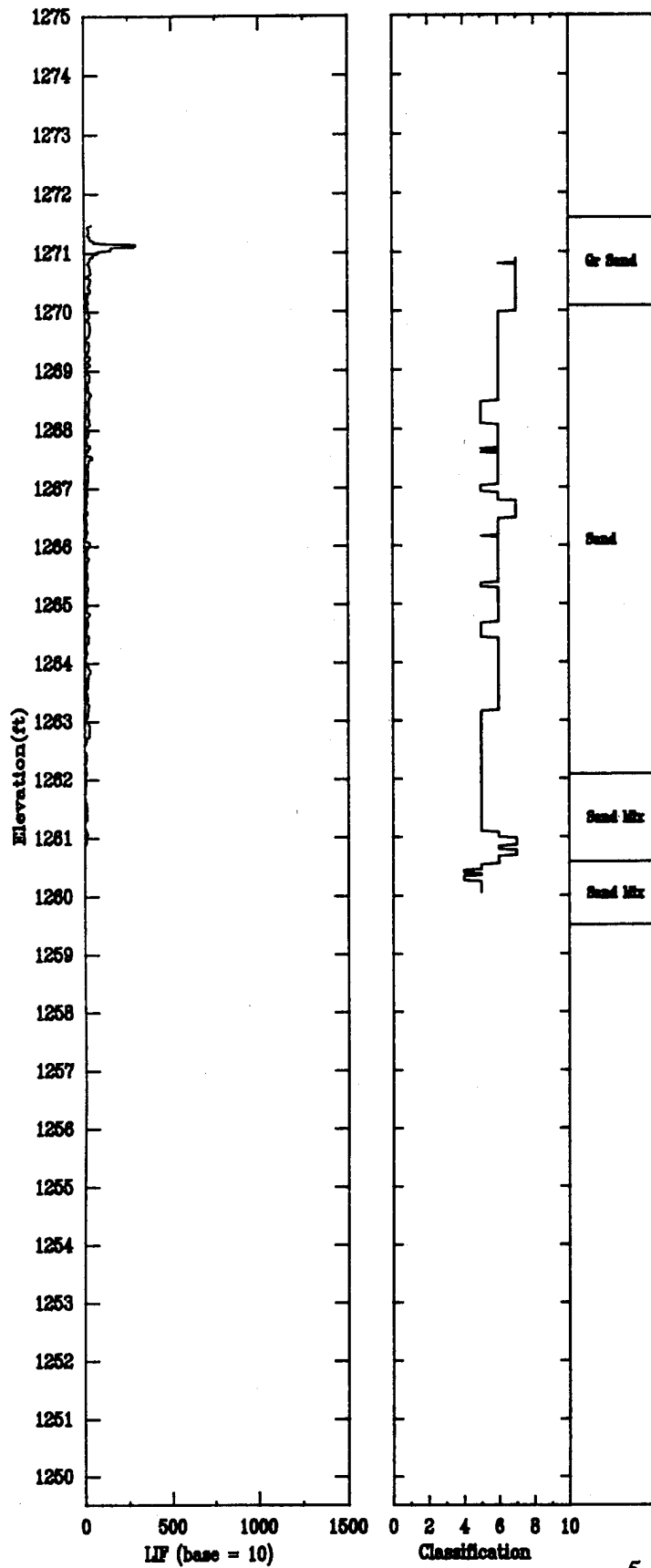
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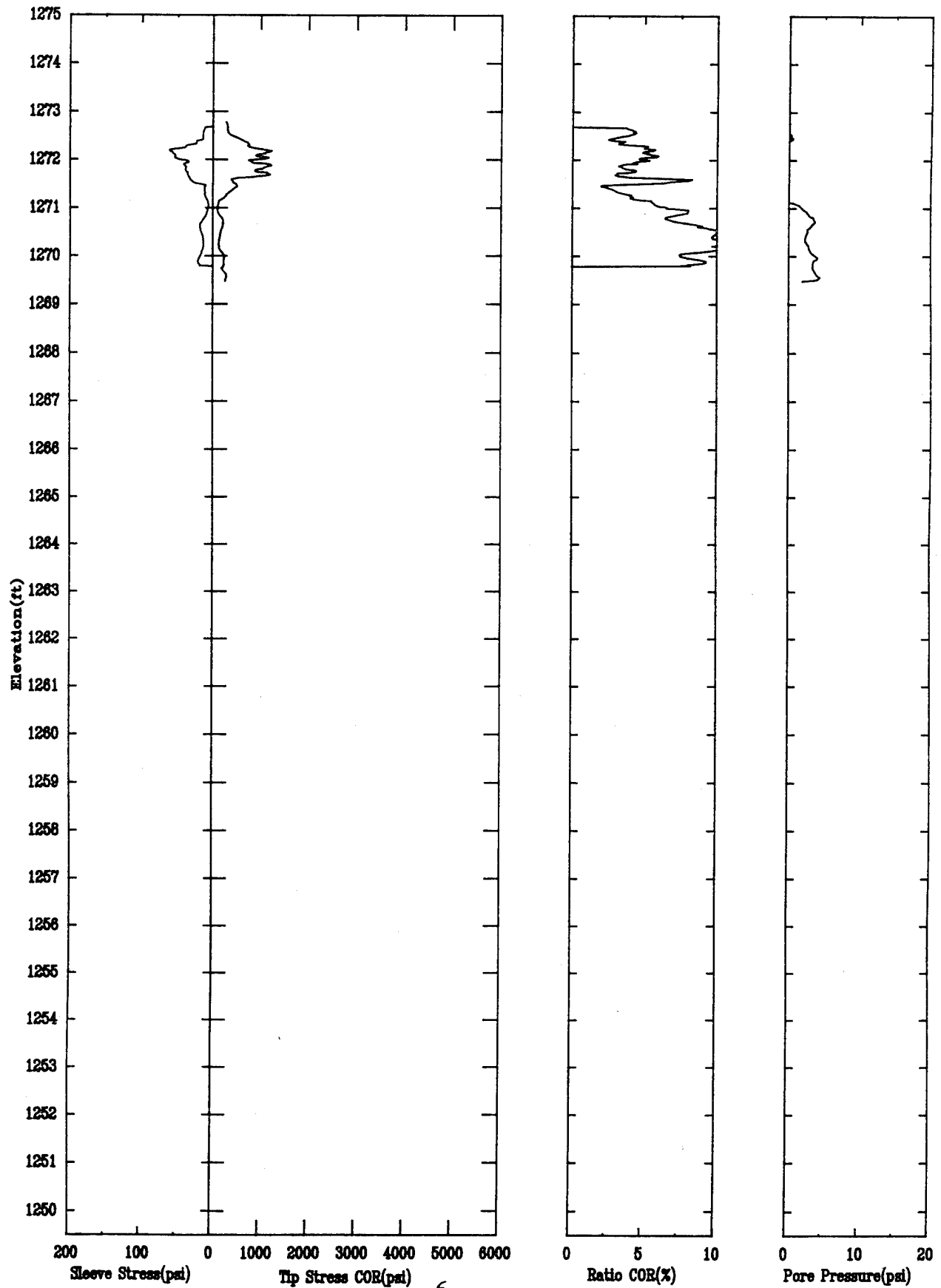
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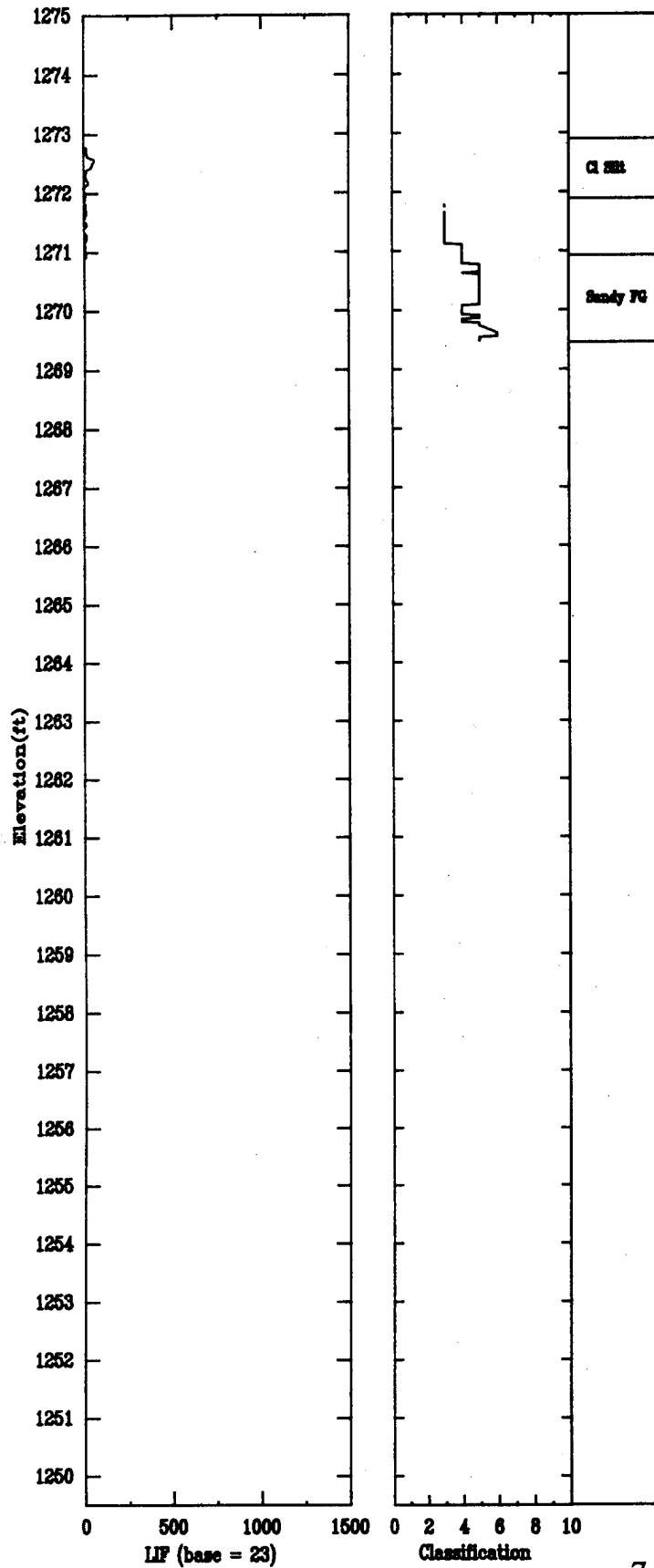
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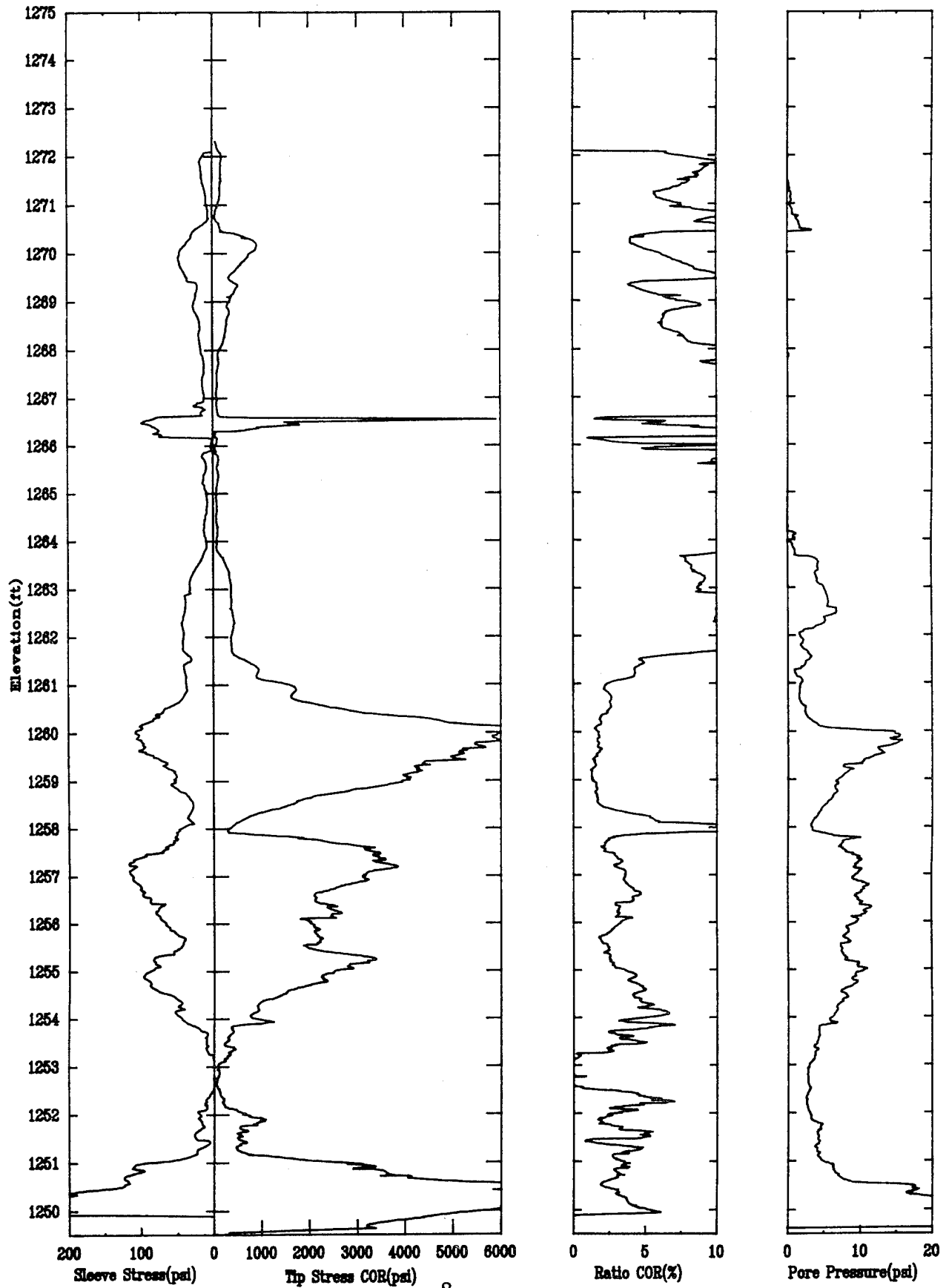
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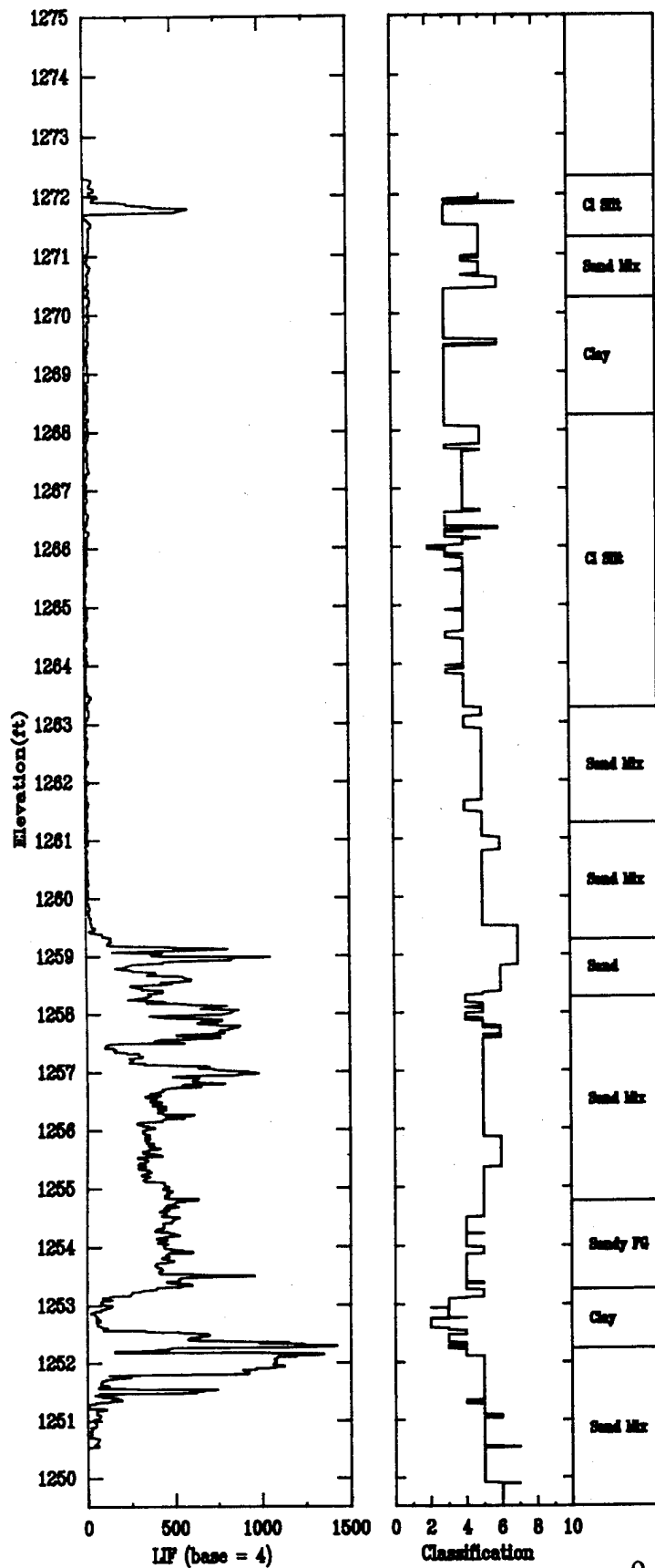
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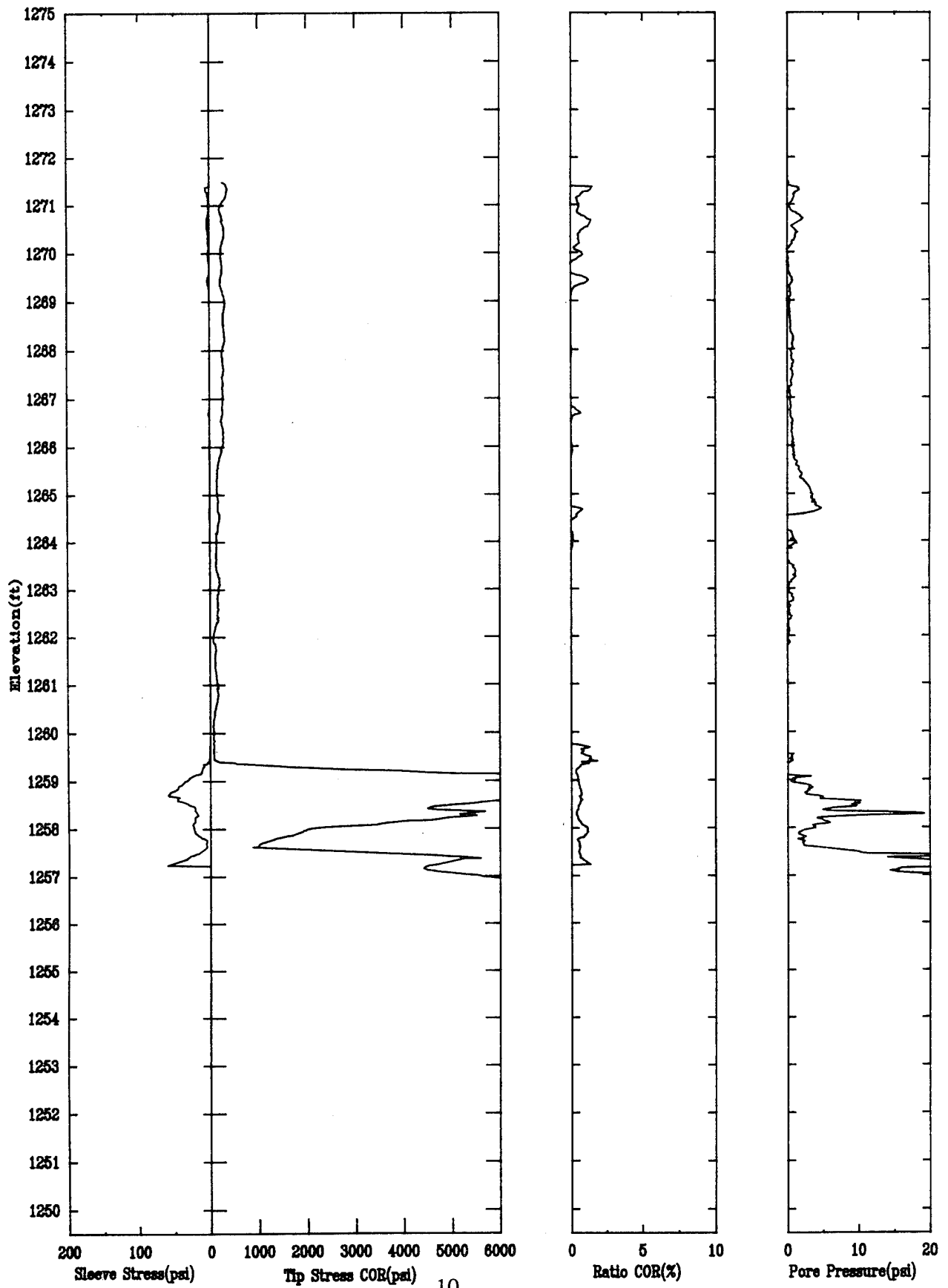
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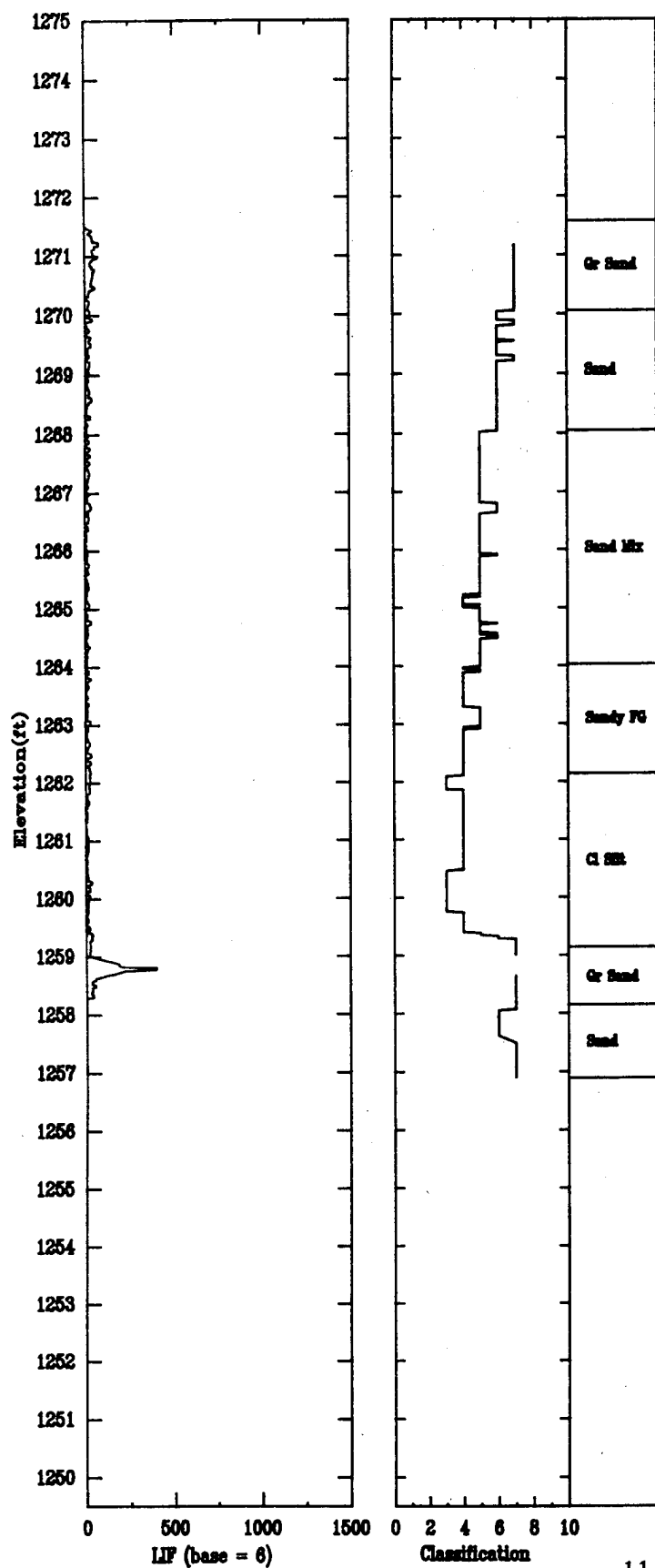
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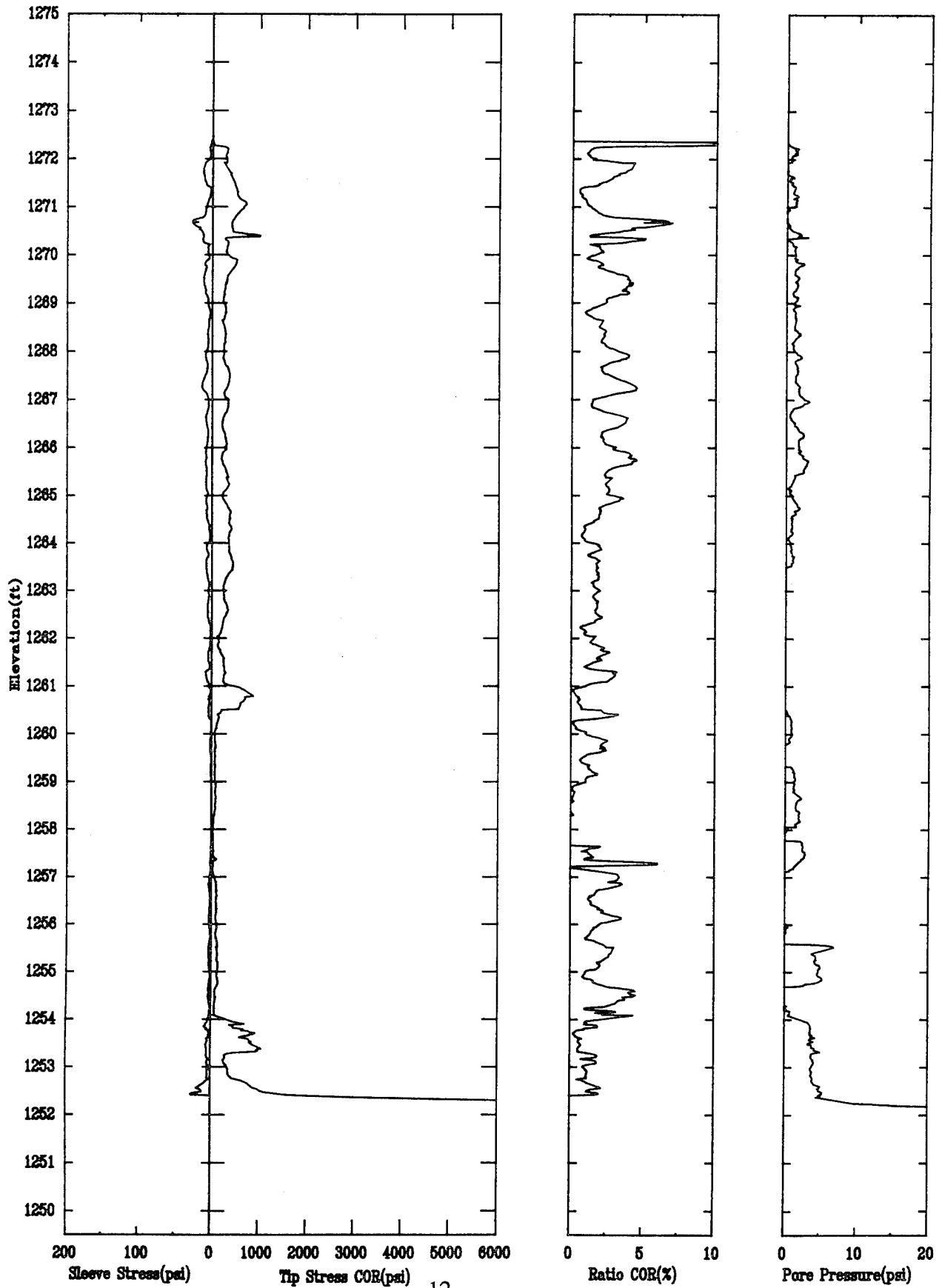
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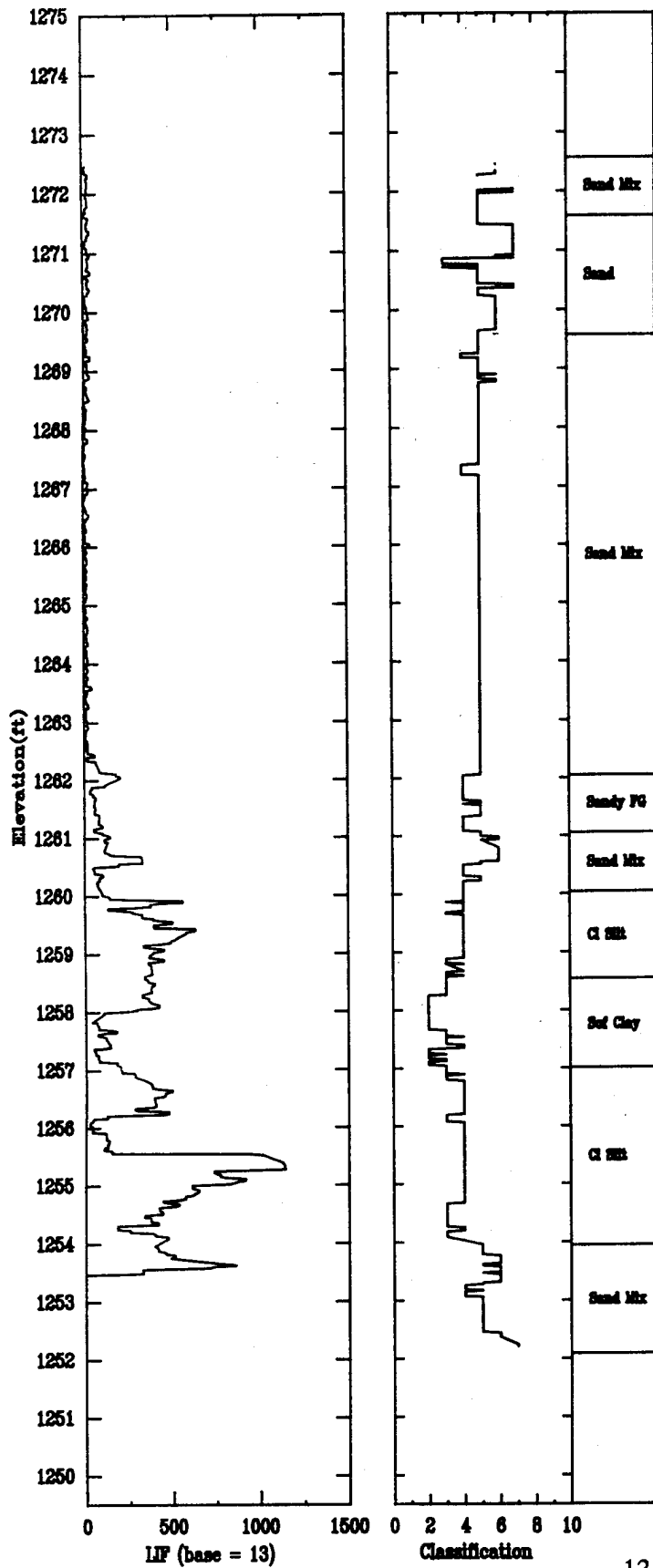
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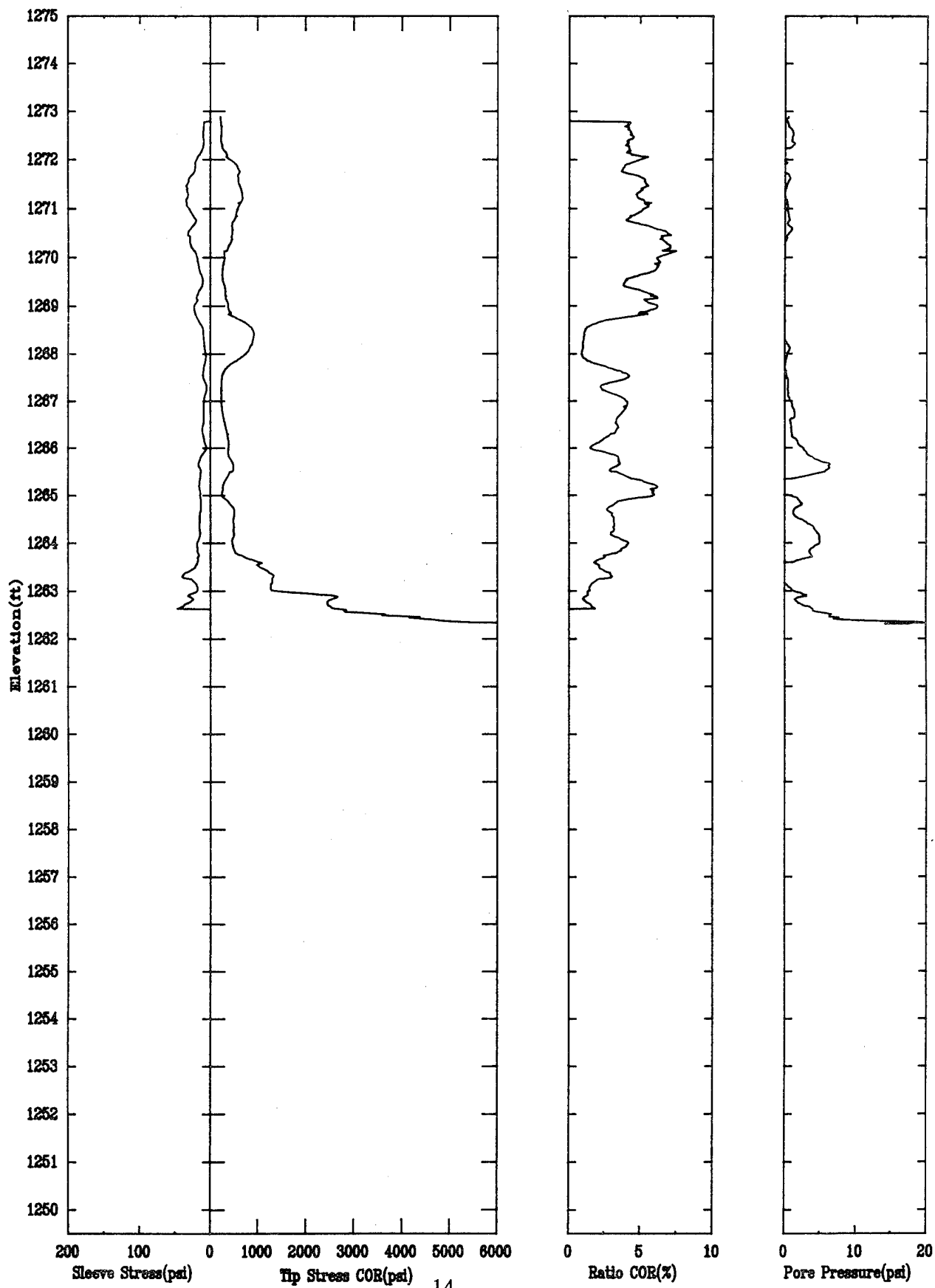
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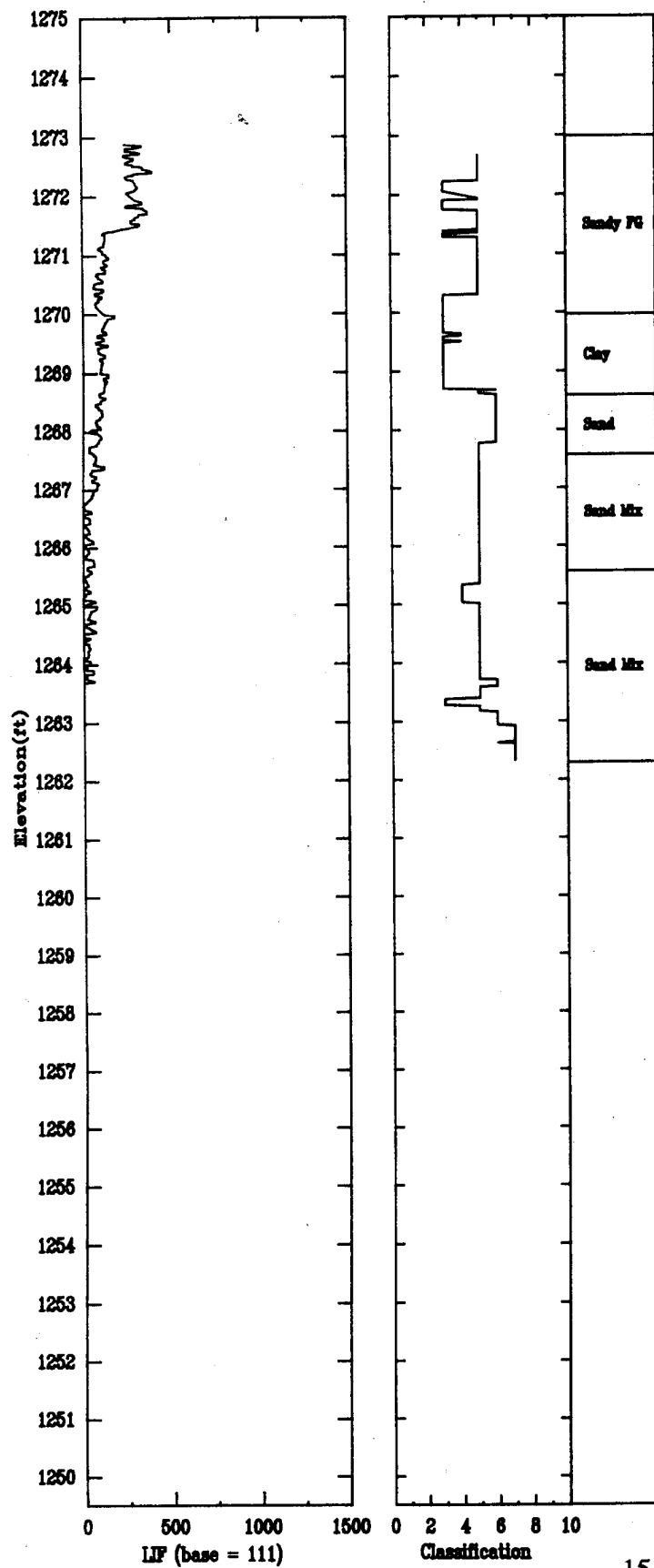
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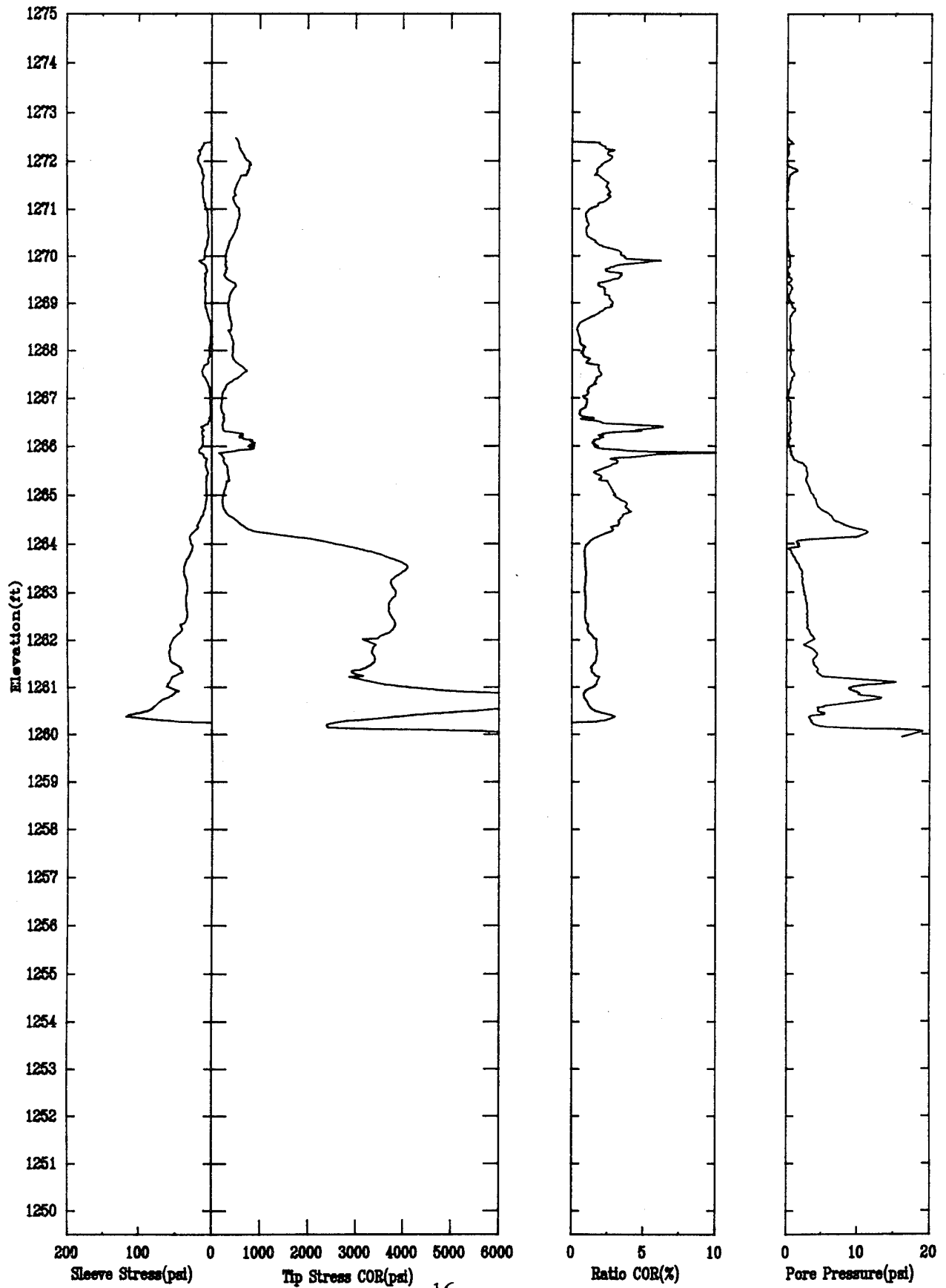
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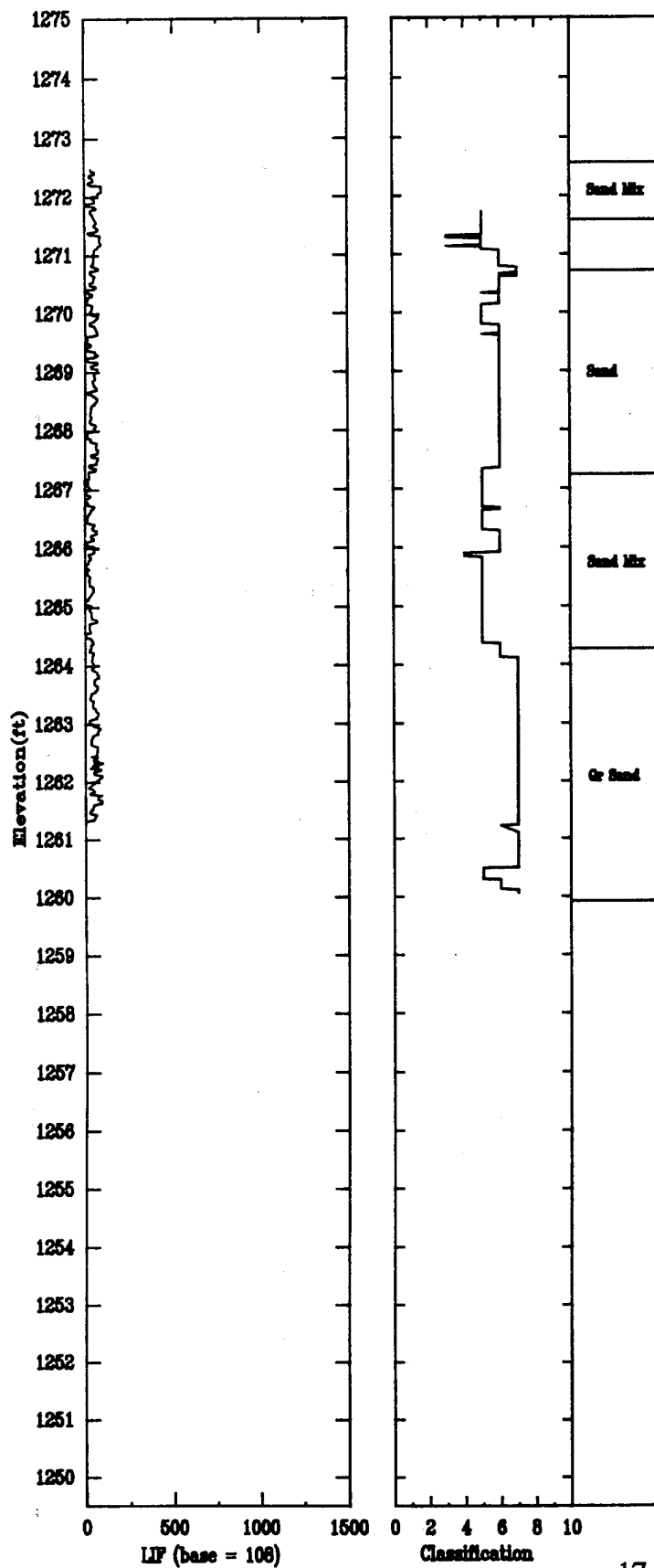
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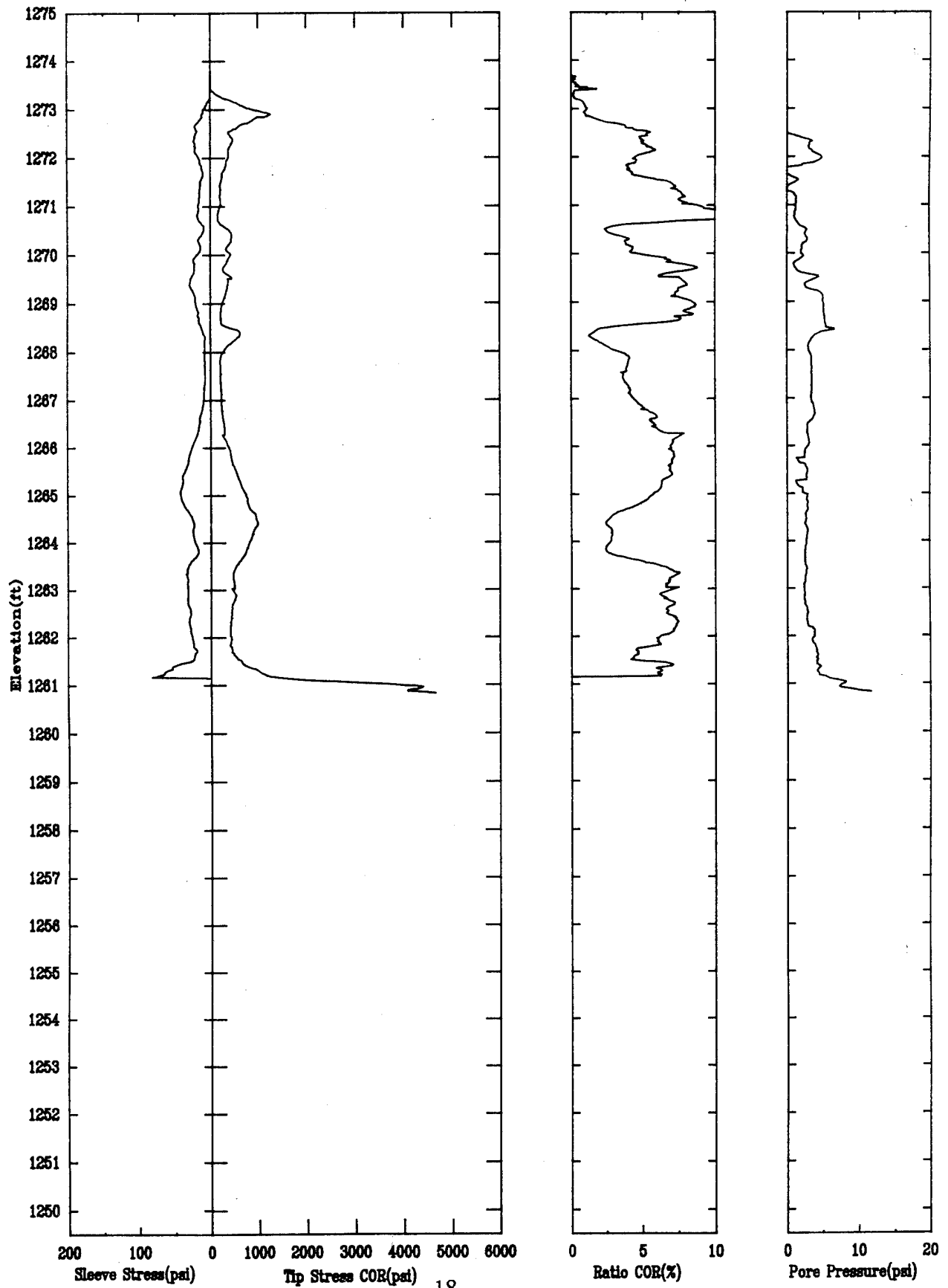
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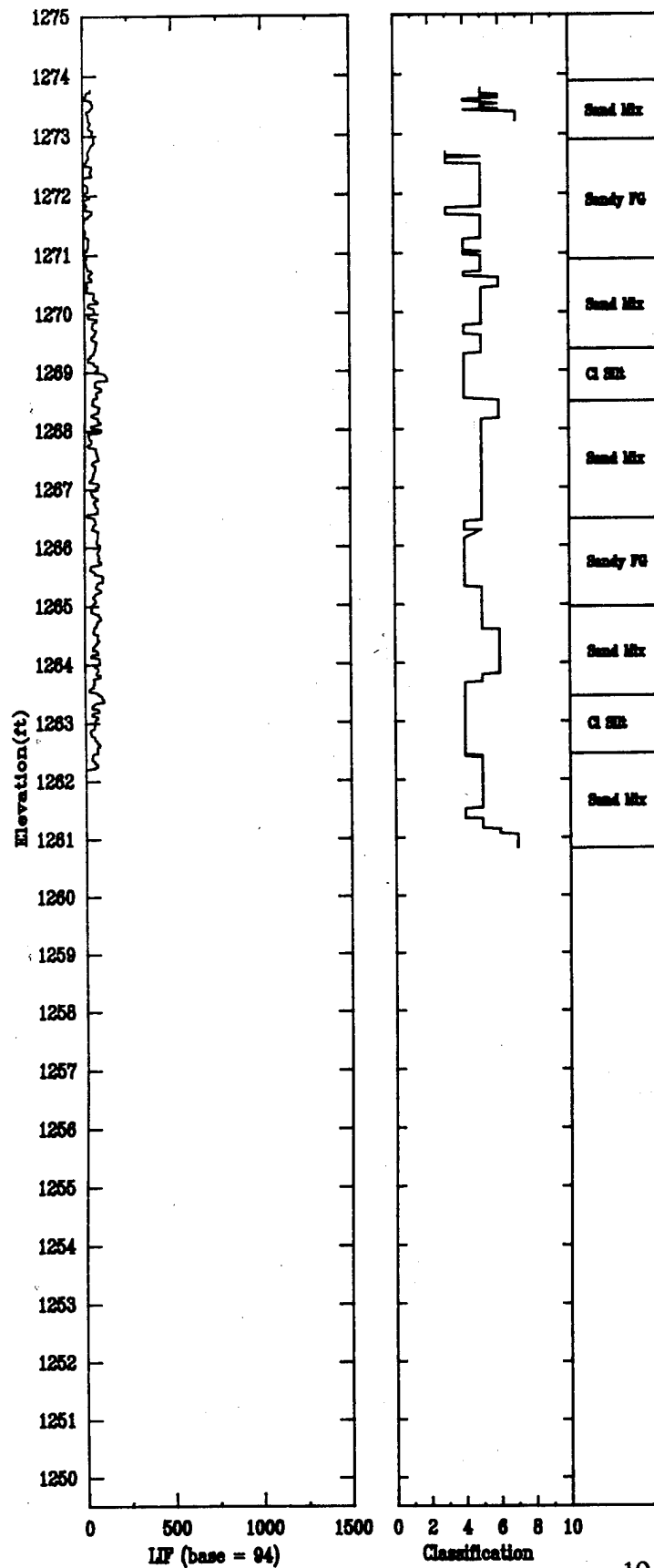
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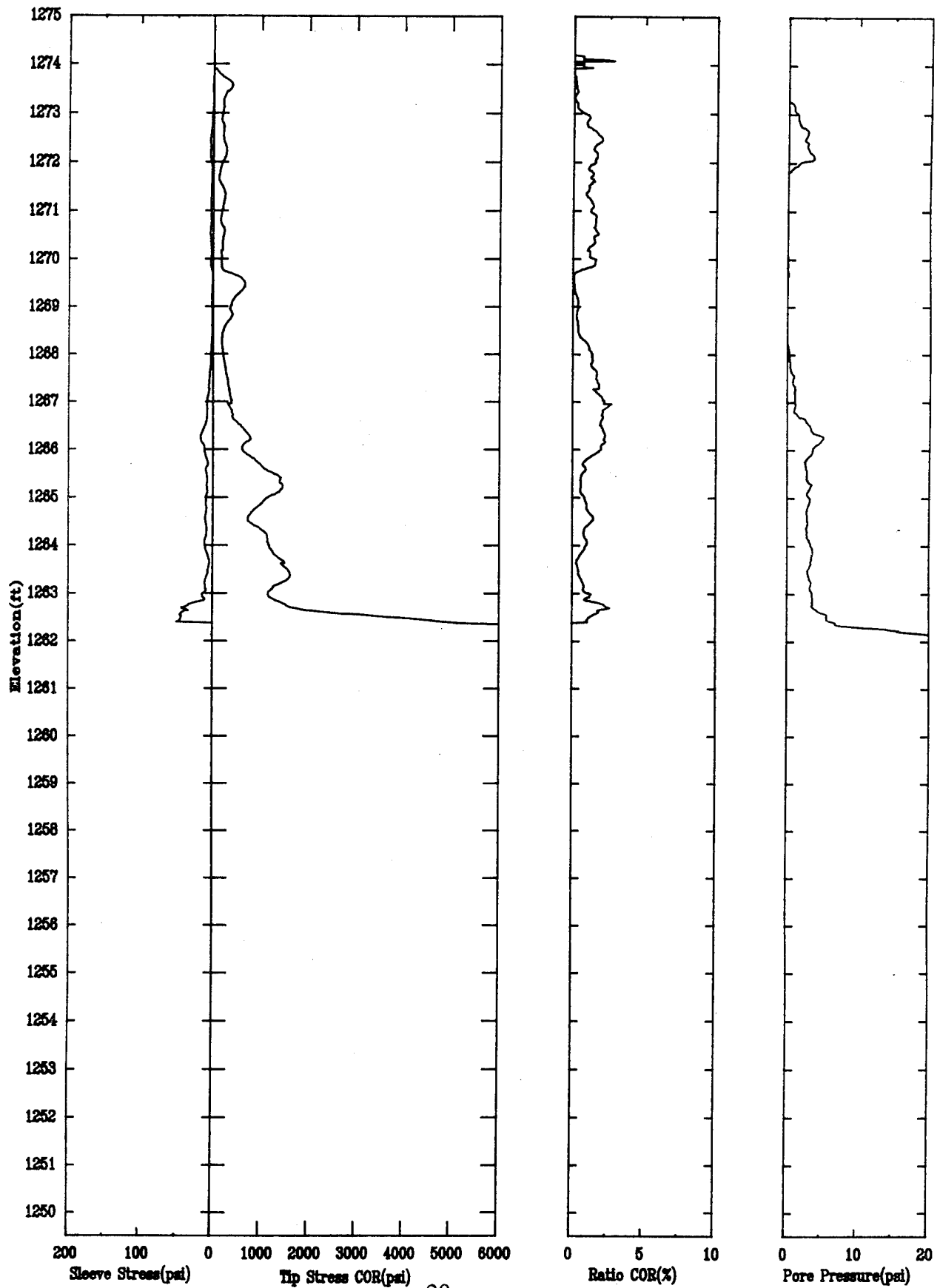
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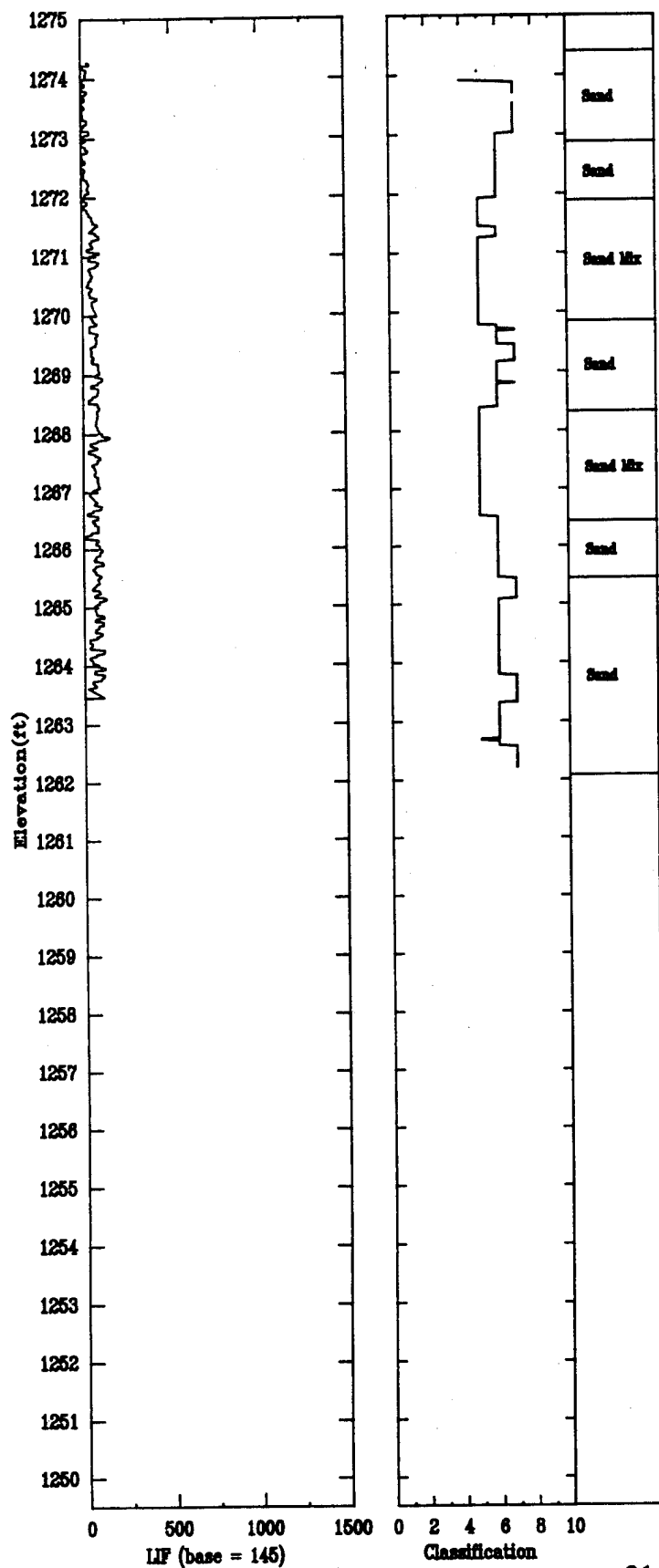
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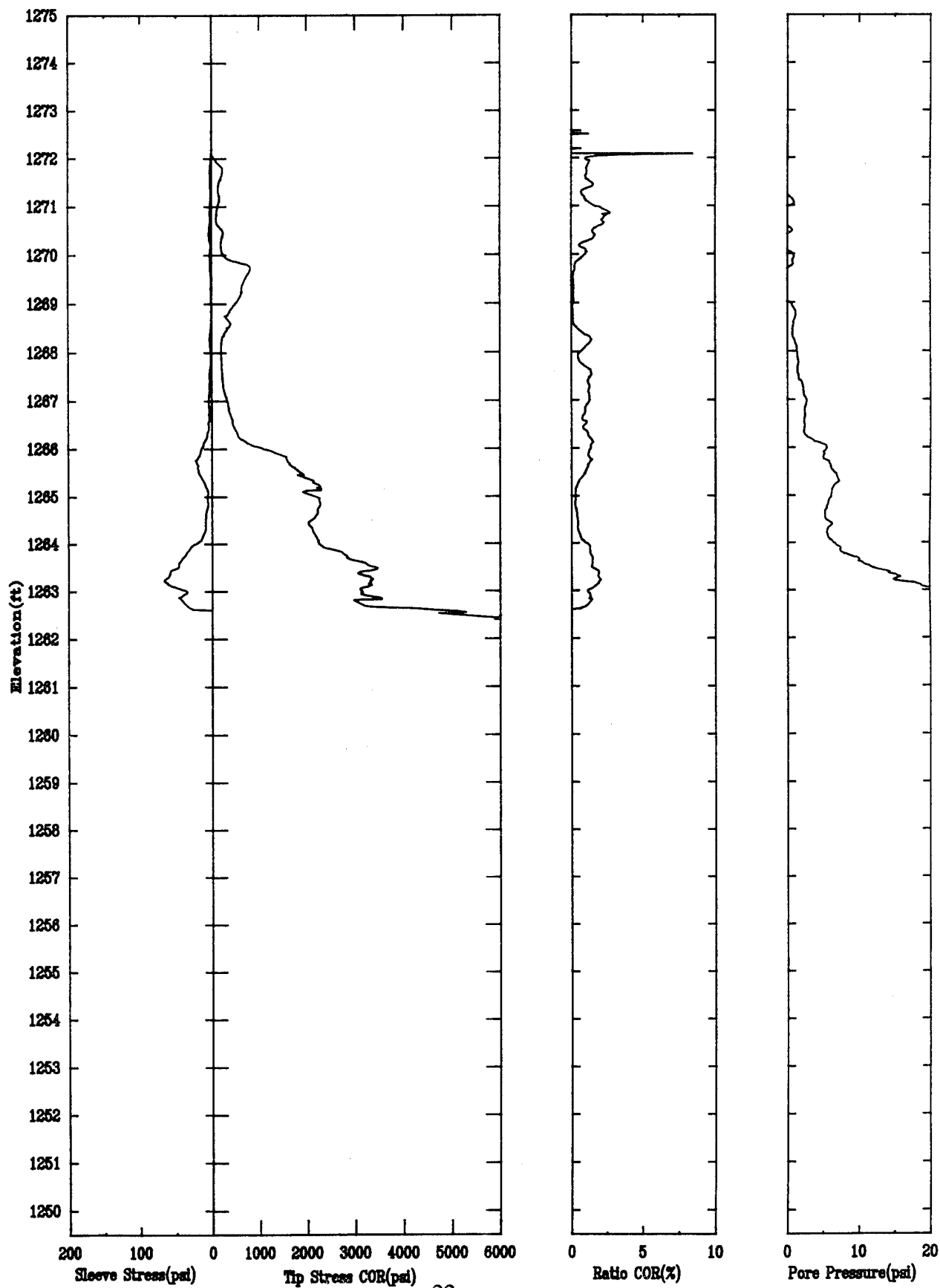
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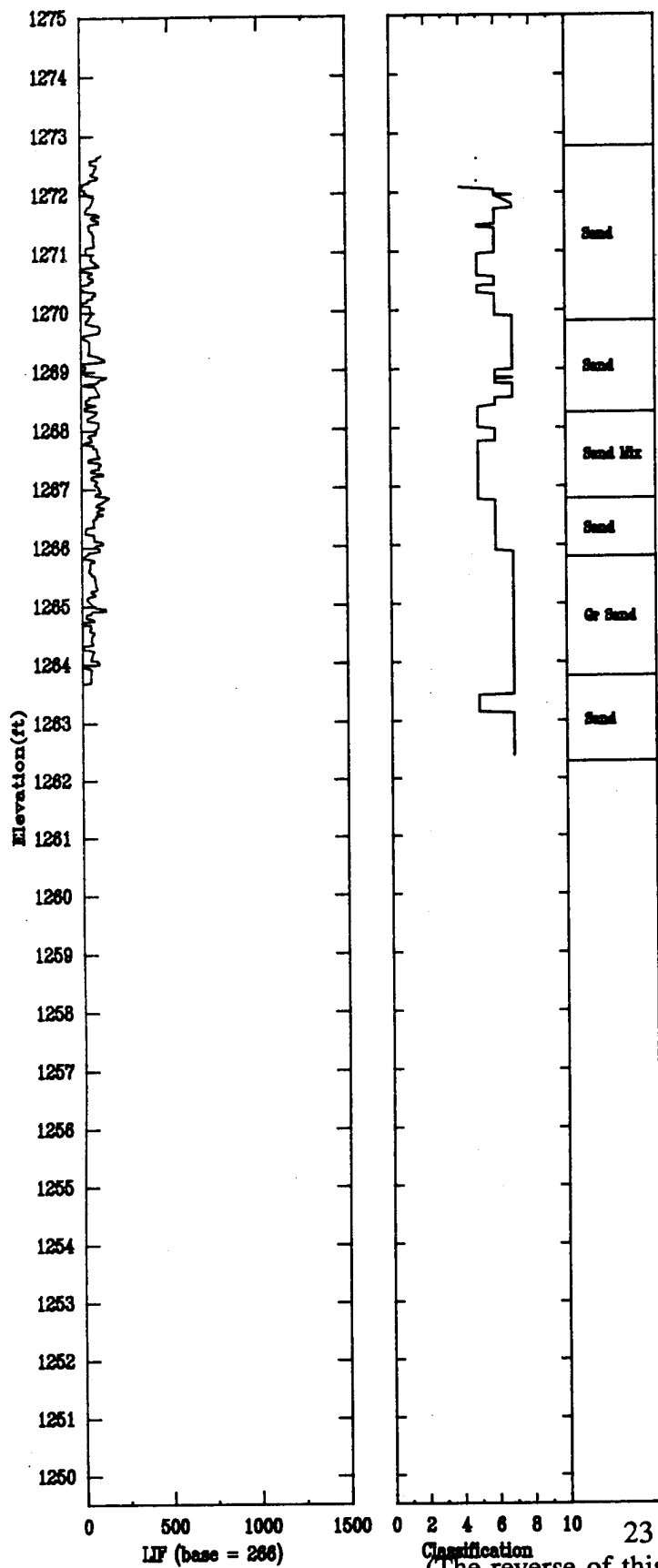
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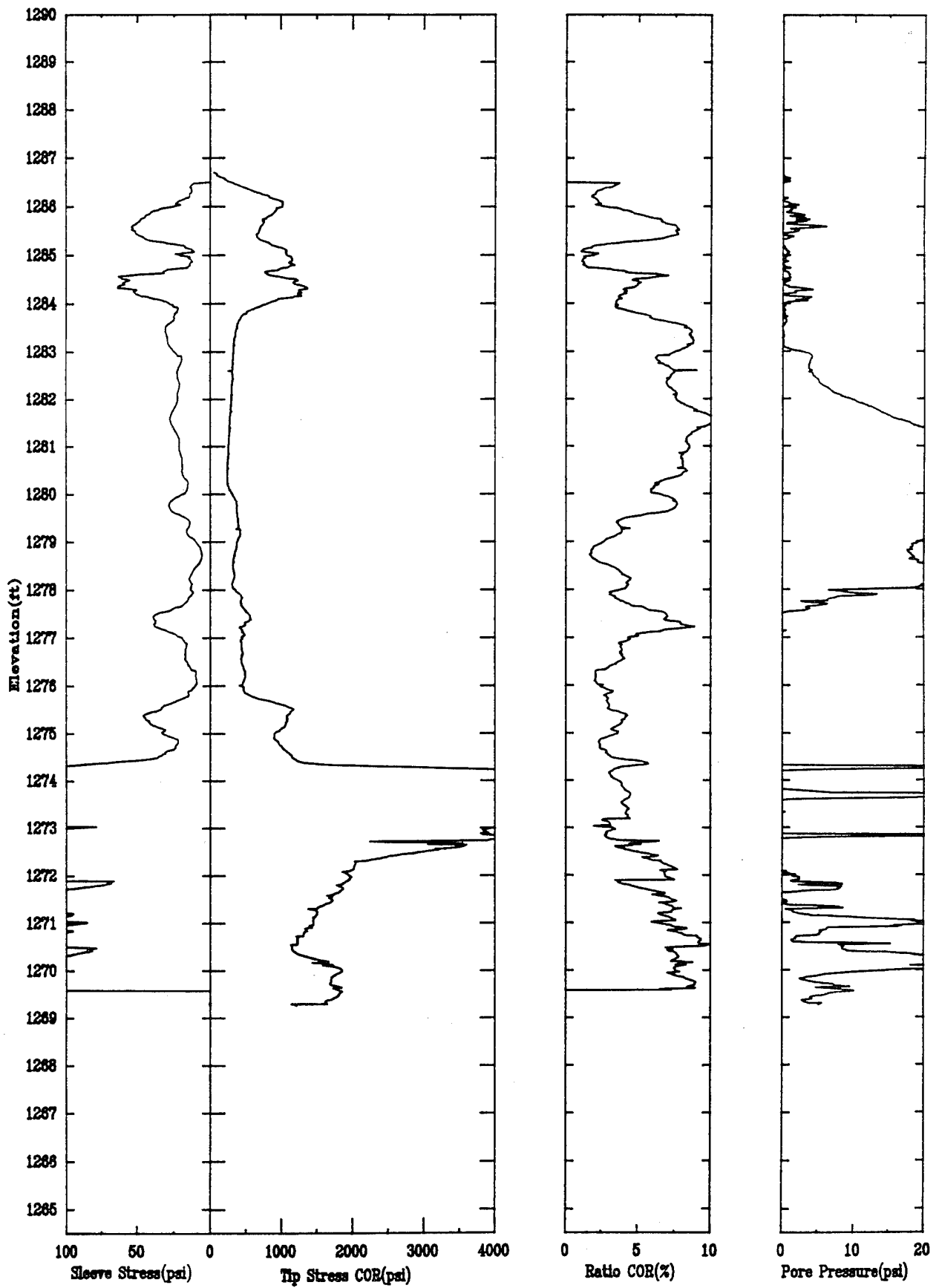


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APPENDIX B

LIF-CPT PROFILES FROM FUEL PURGE AREA



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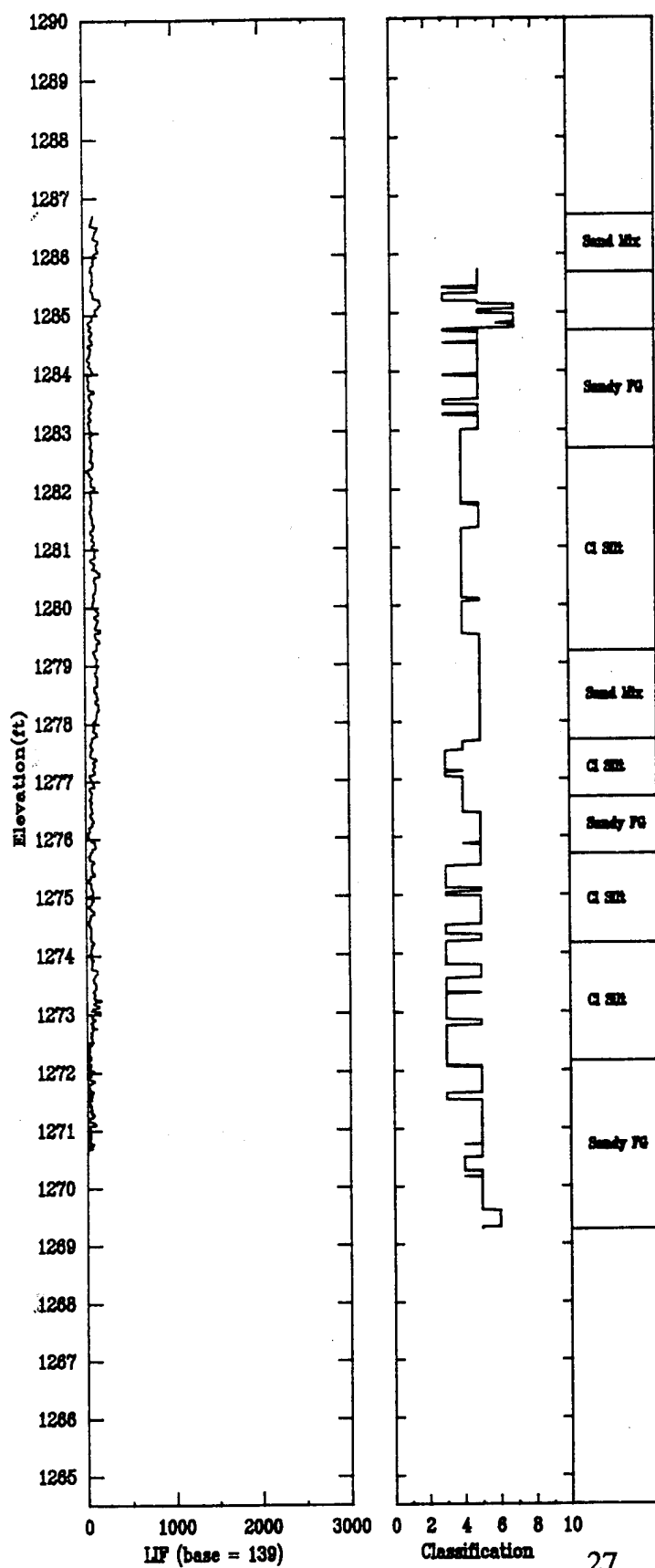
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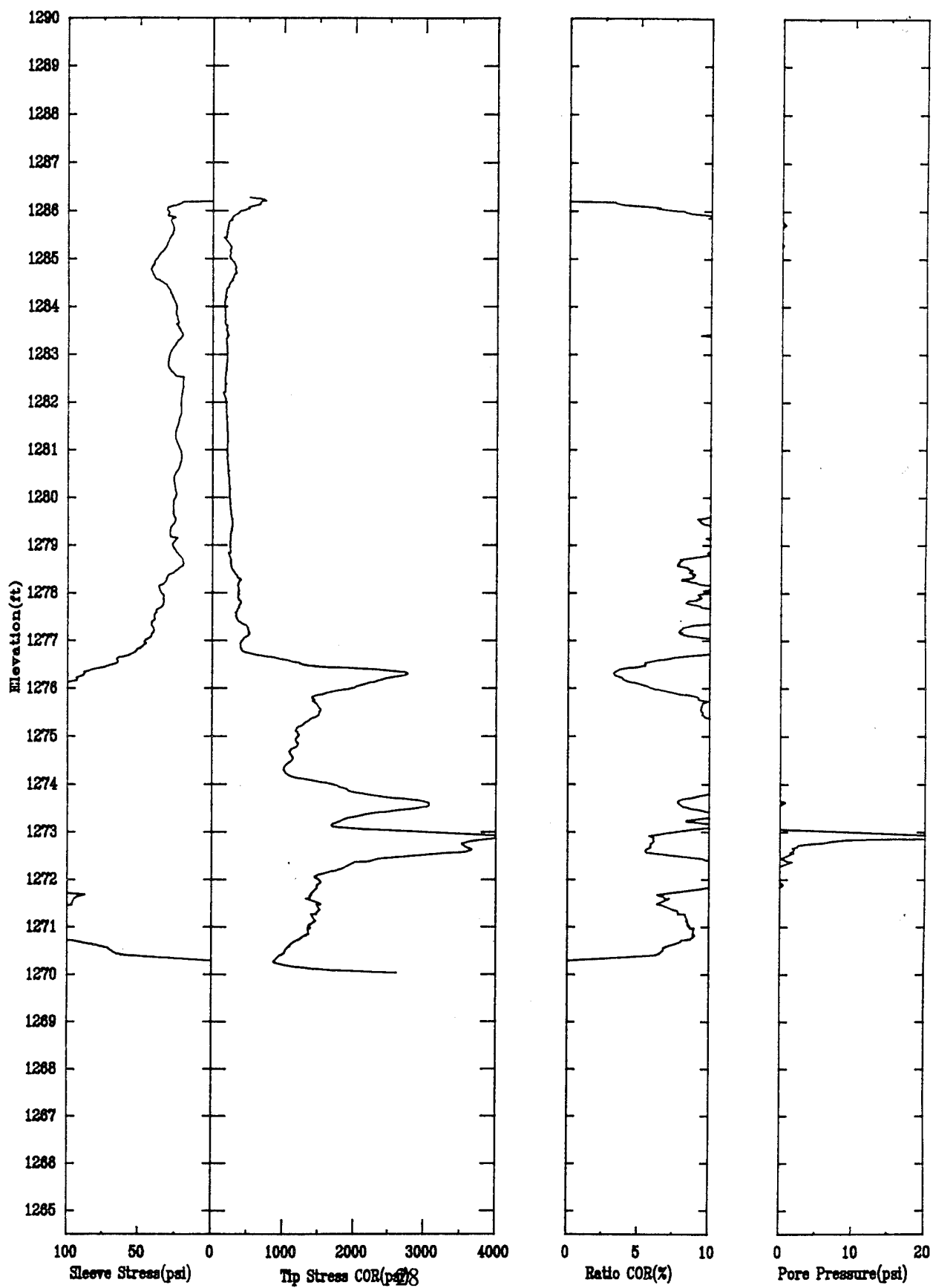
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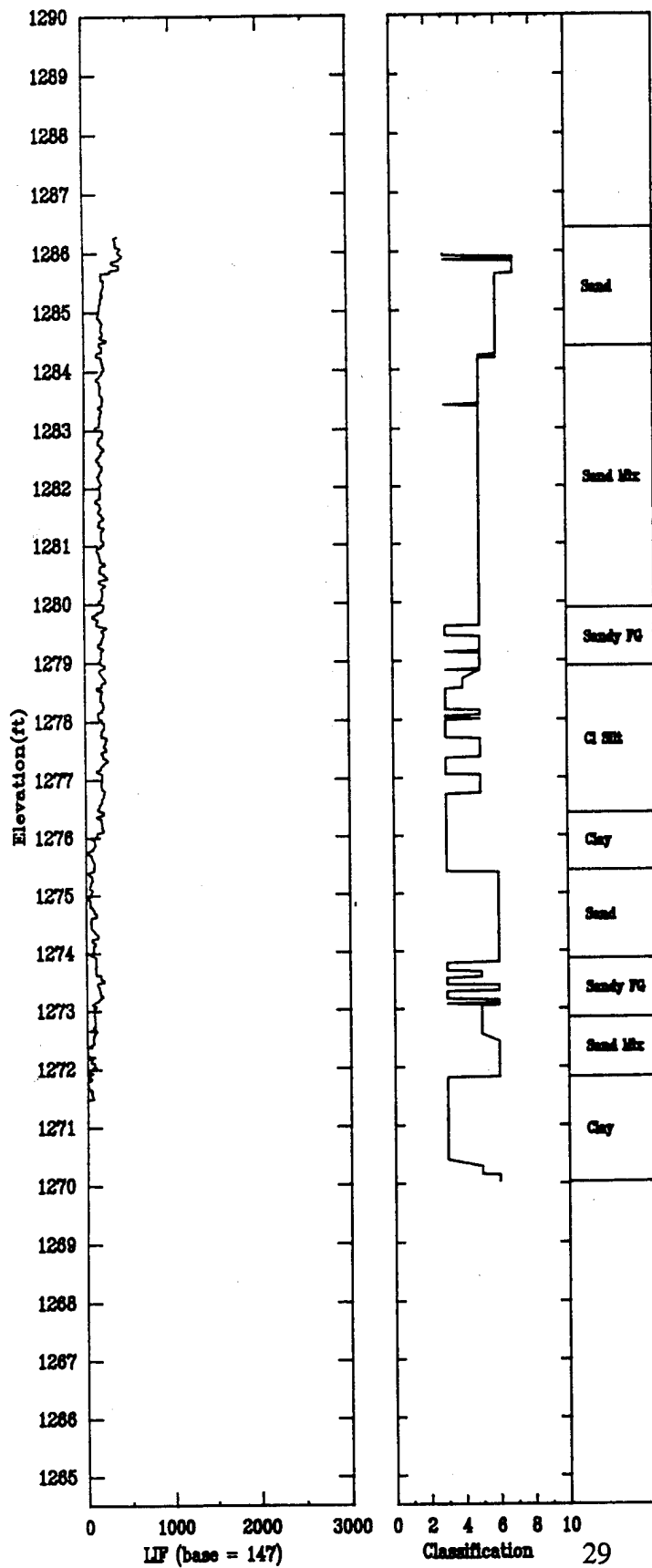
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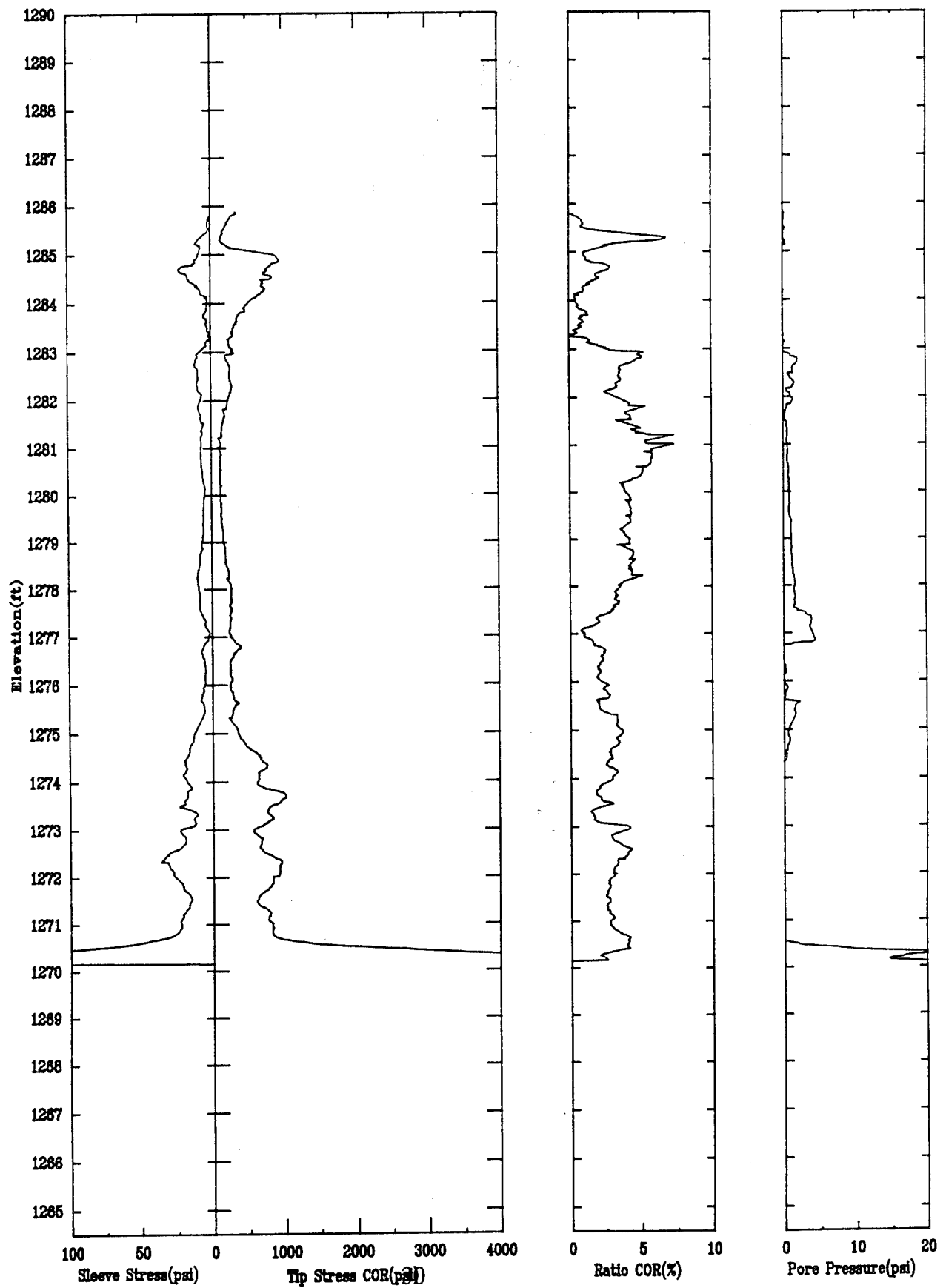
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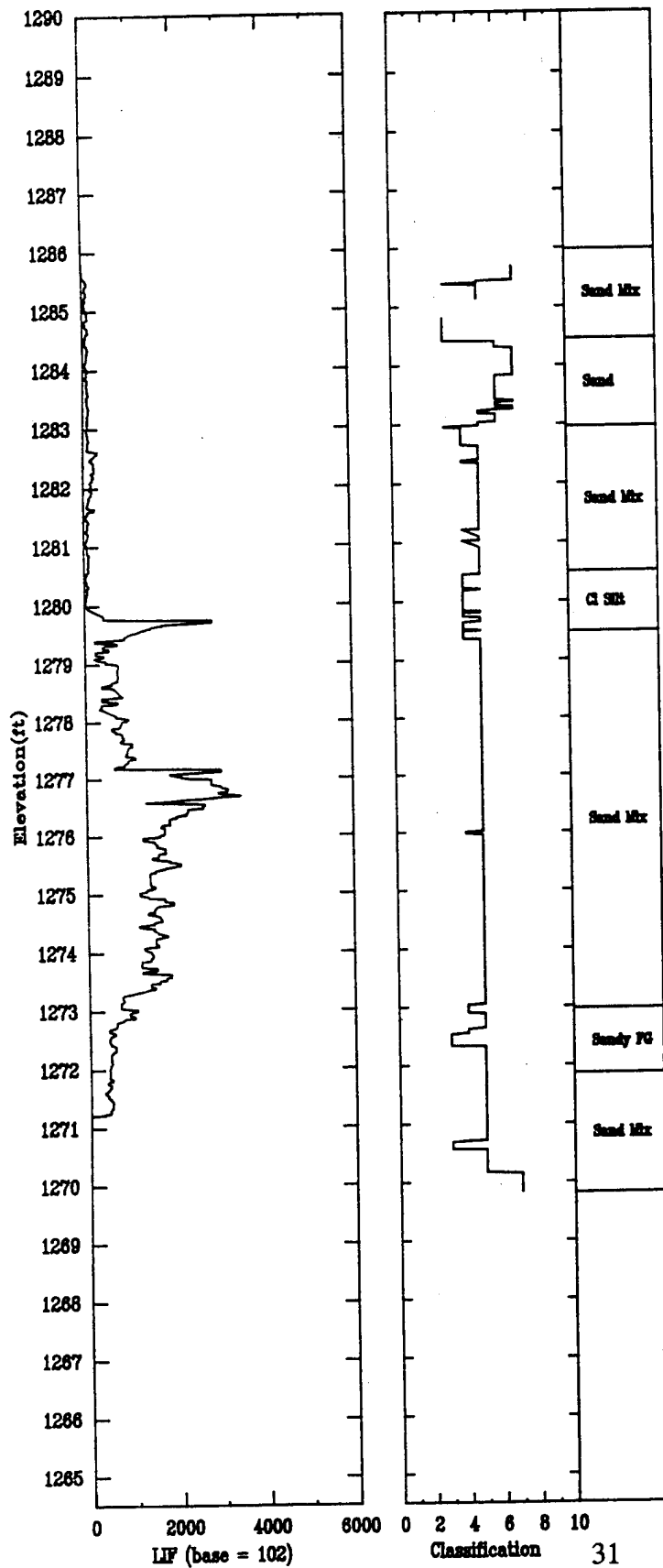
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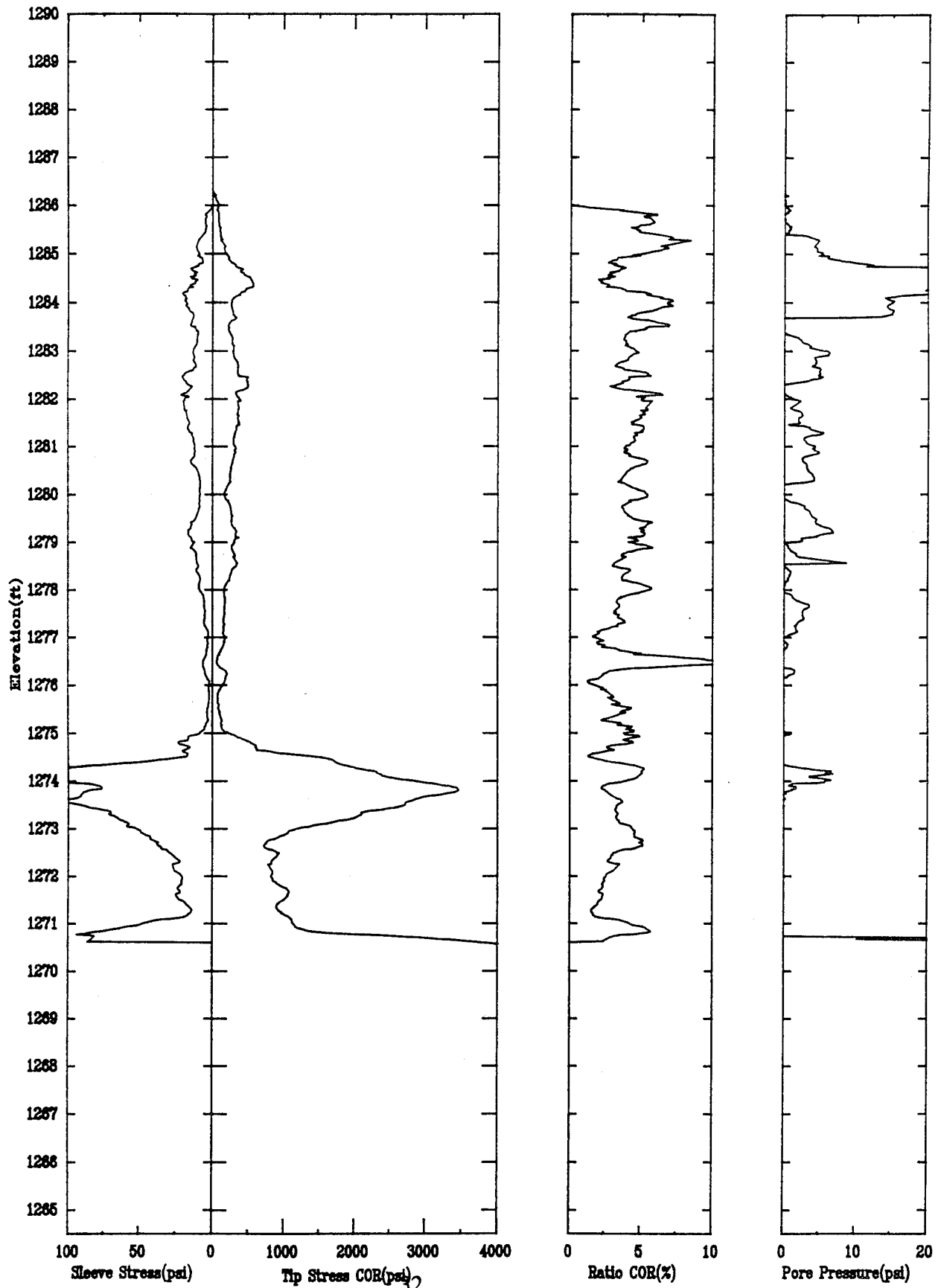
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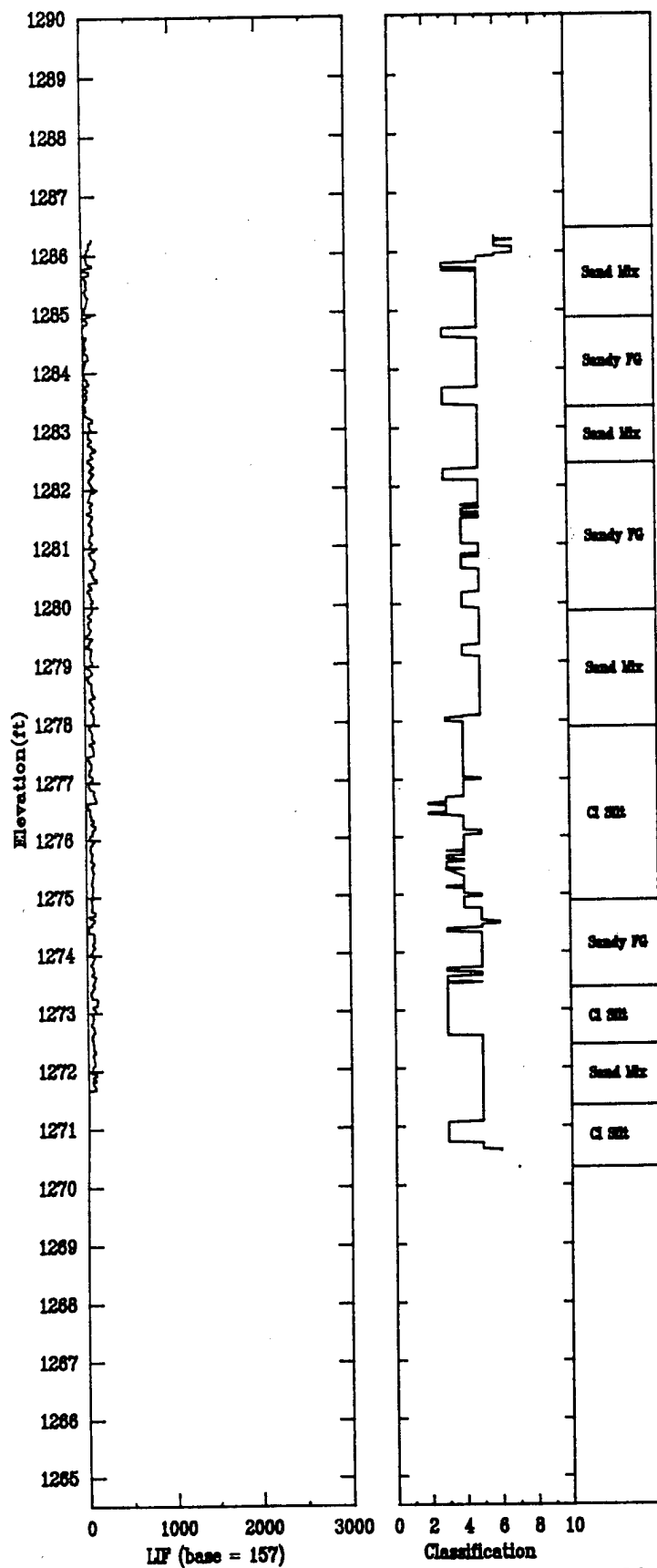
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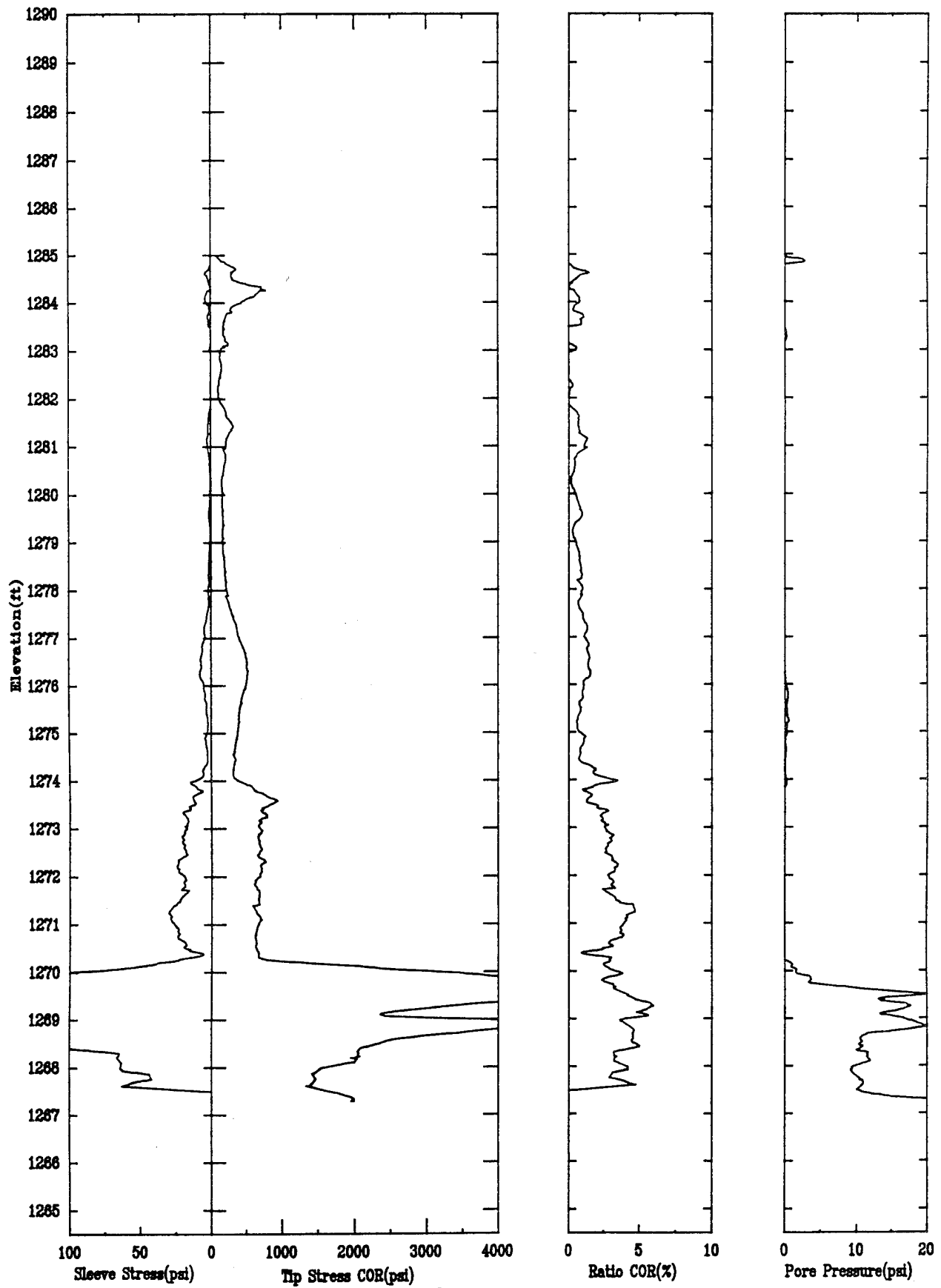
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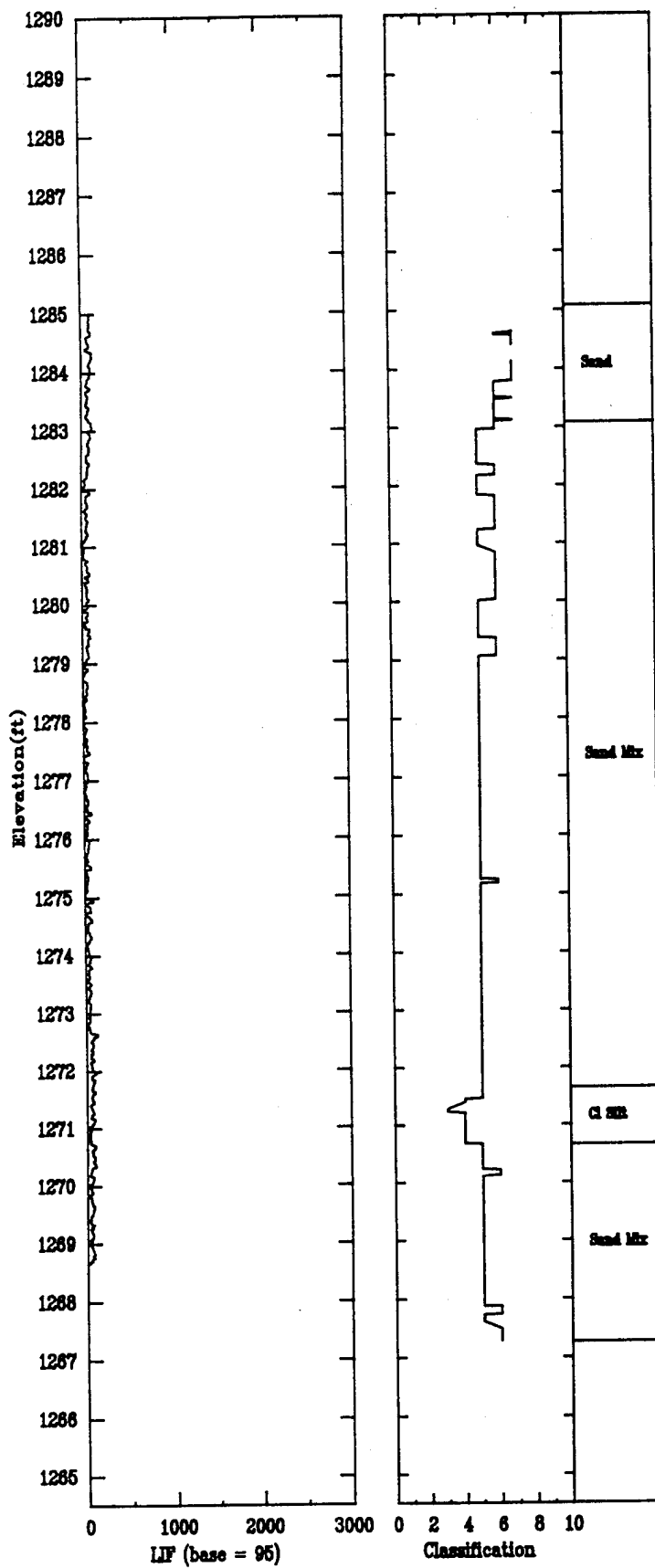
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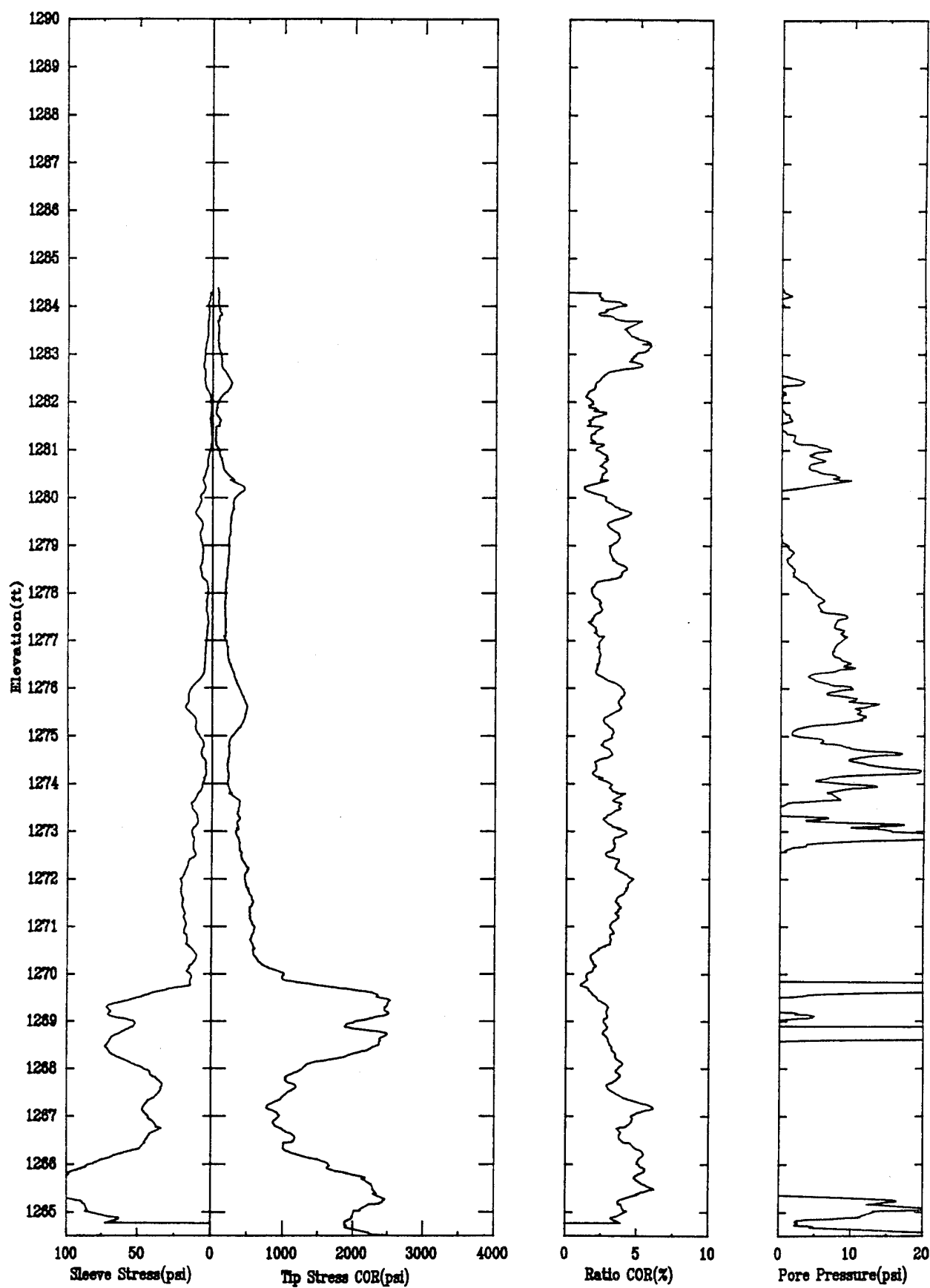
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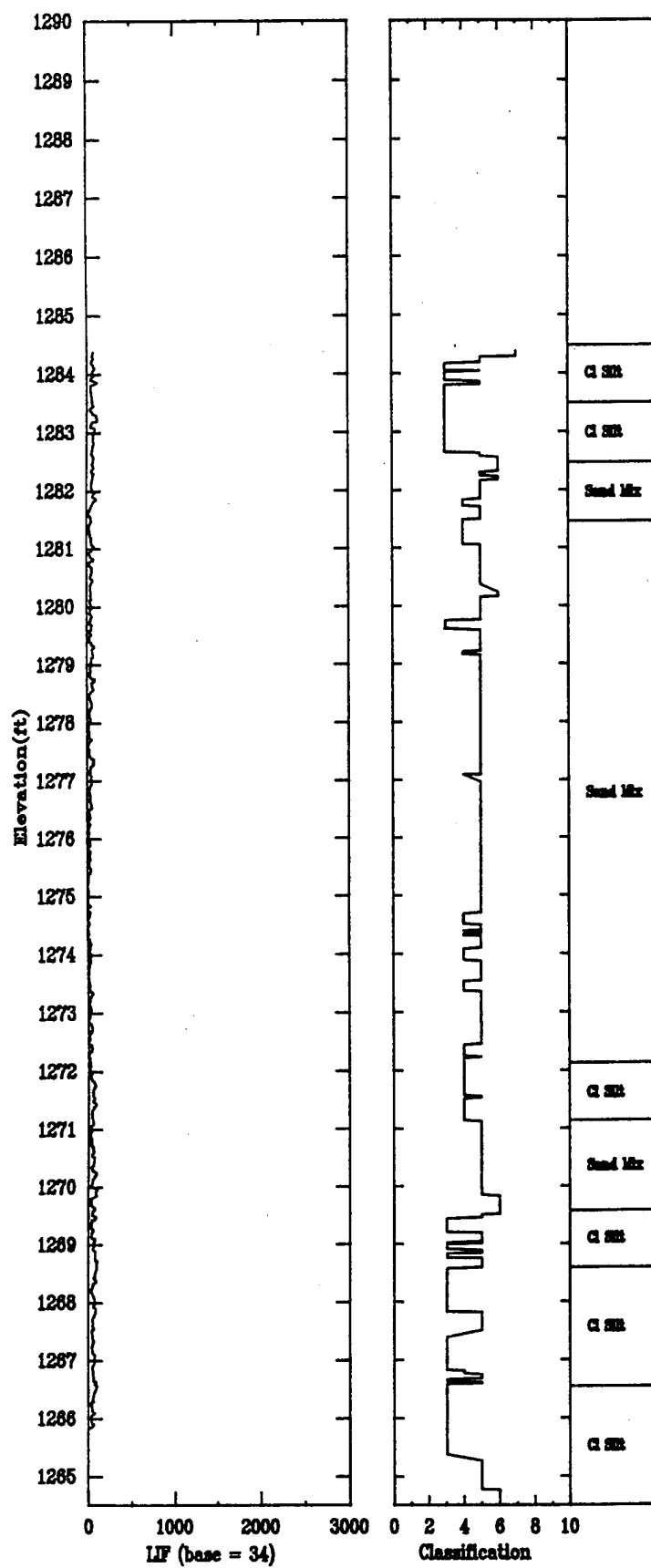
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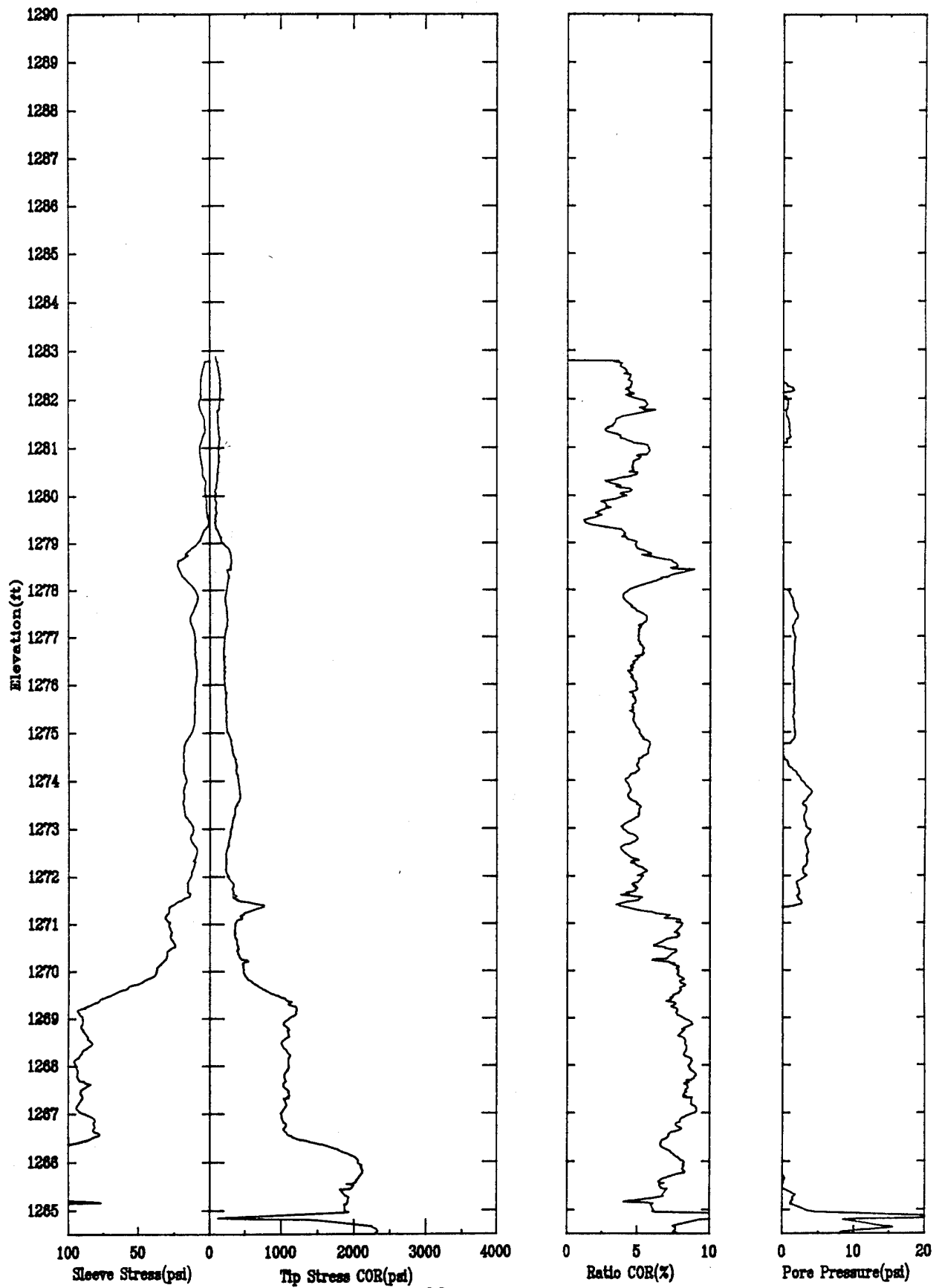
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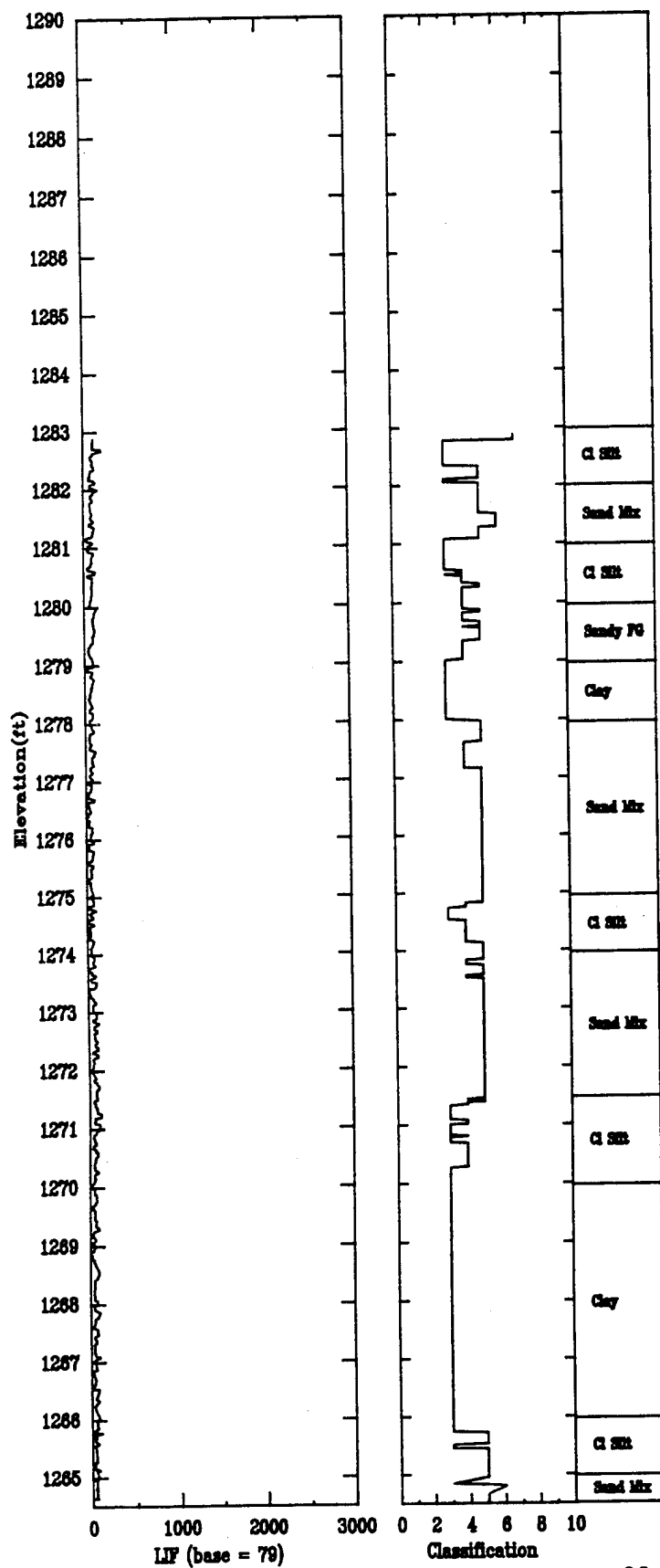
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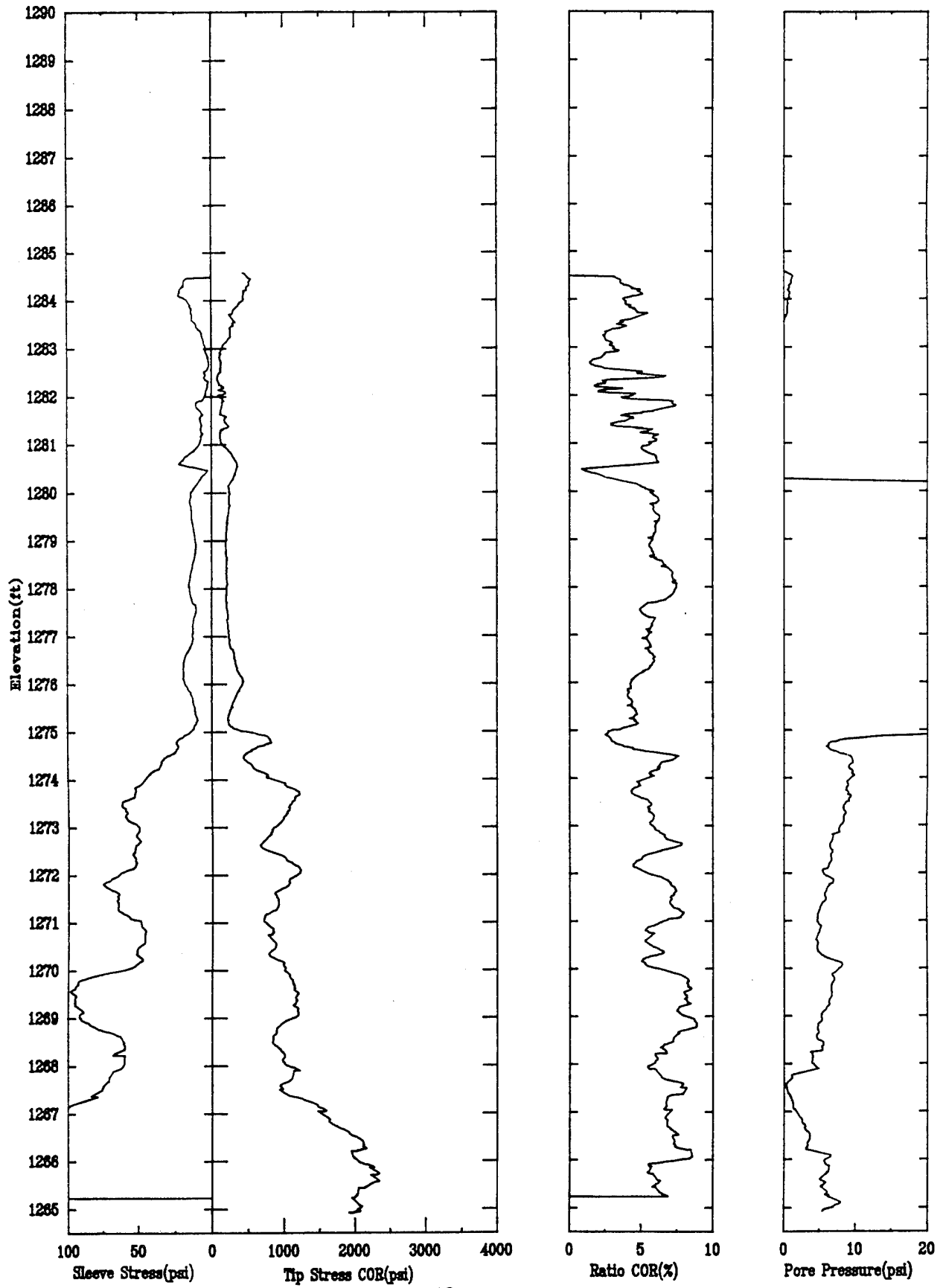
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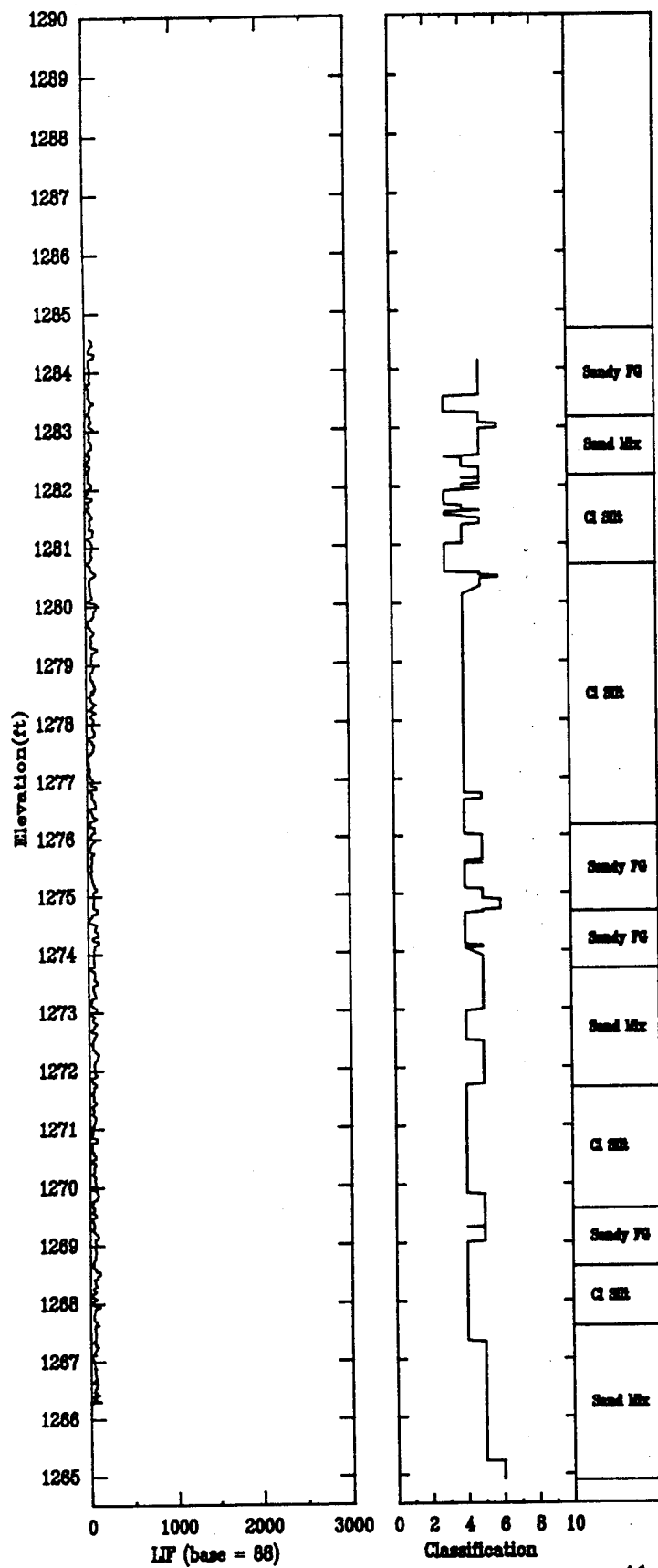
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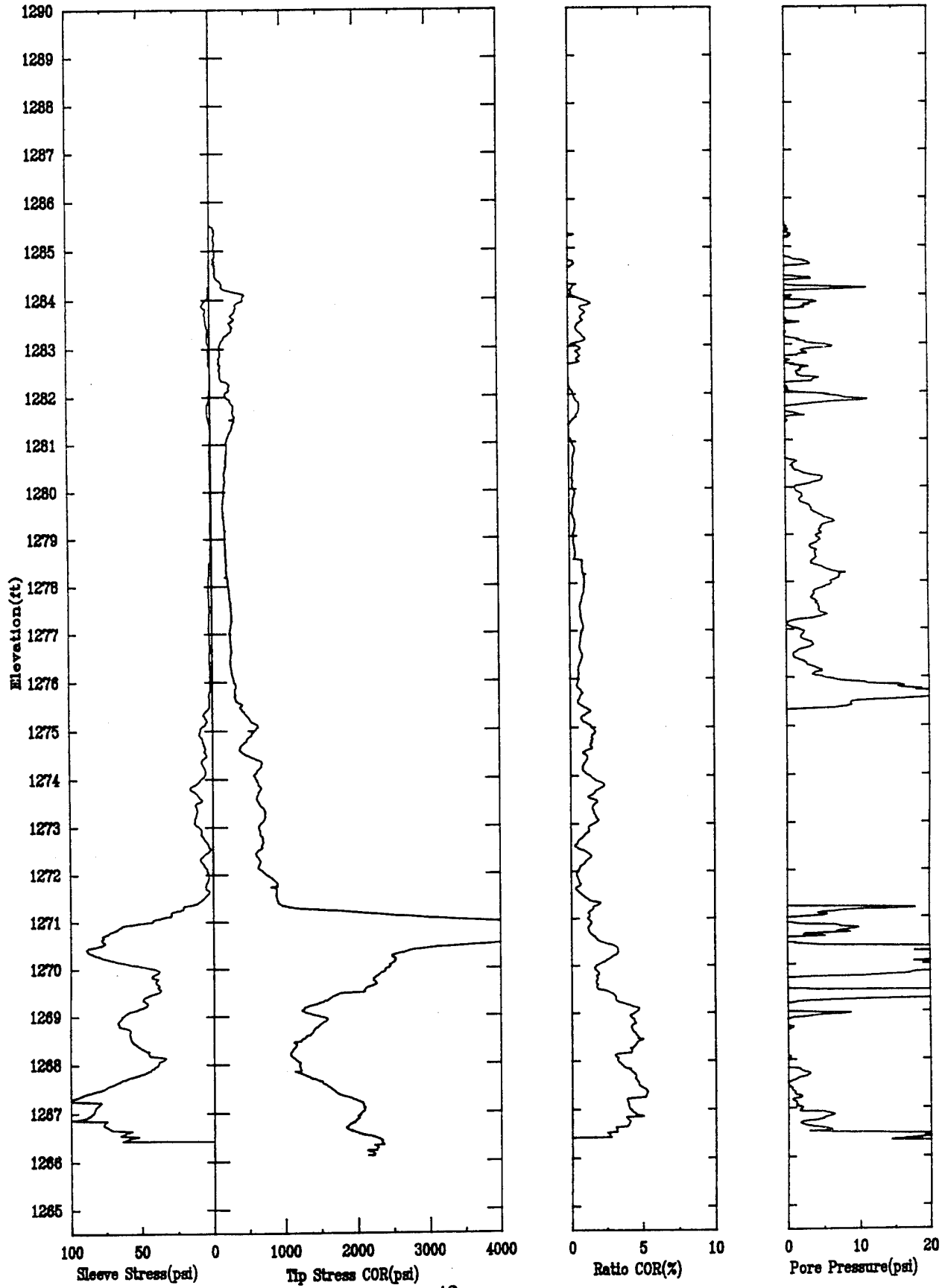
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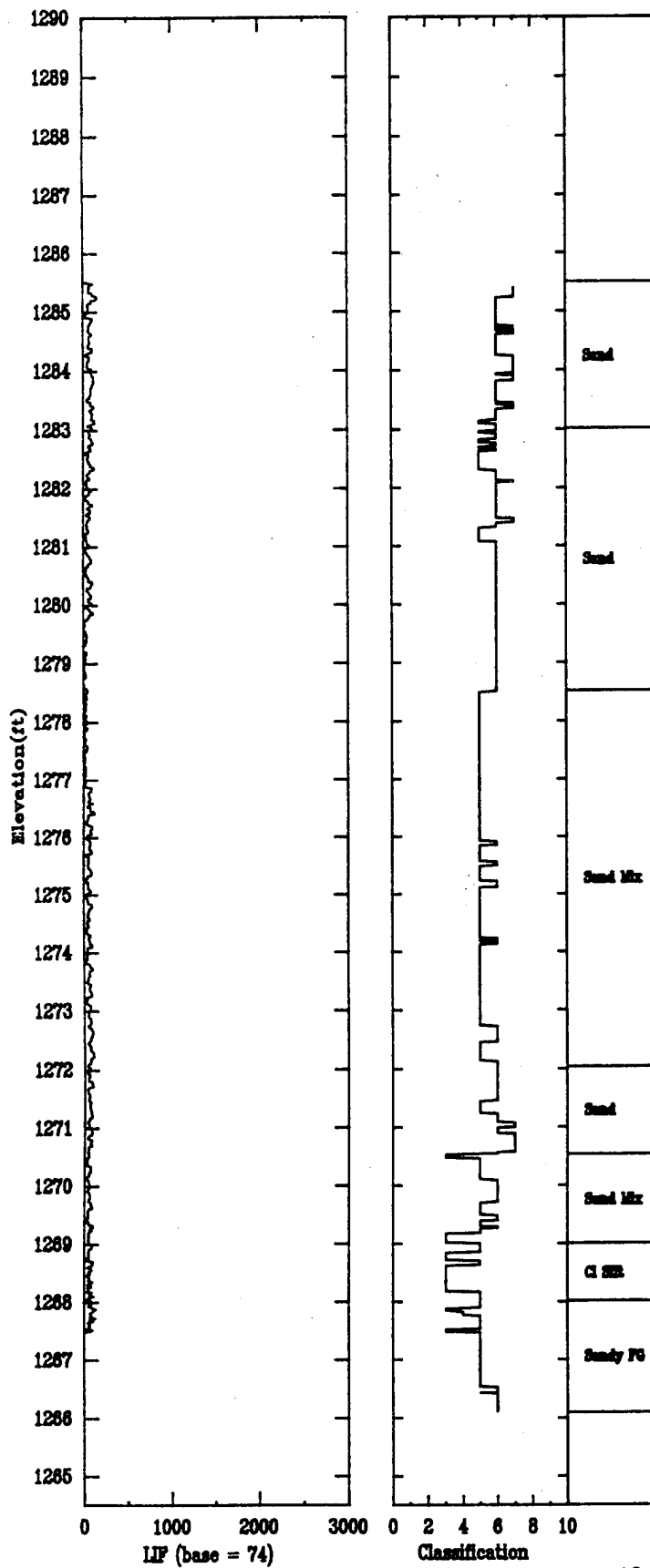
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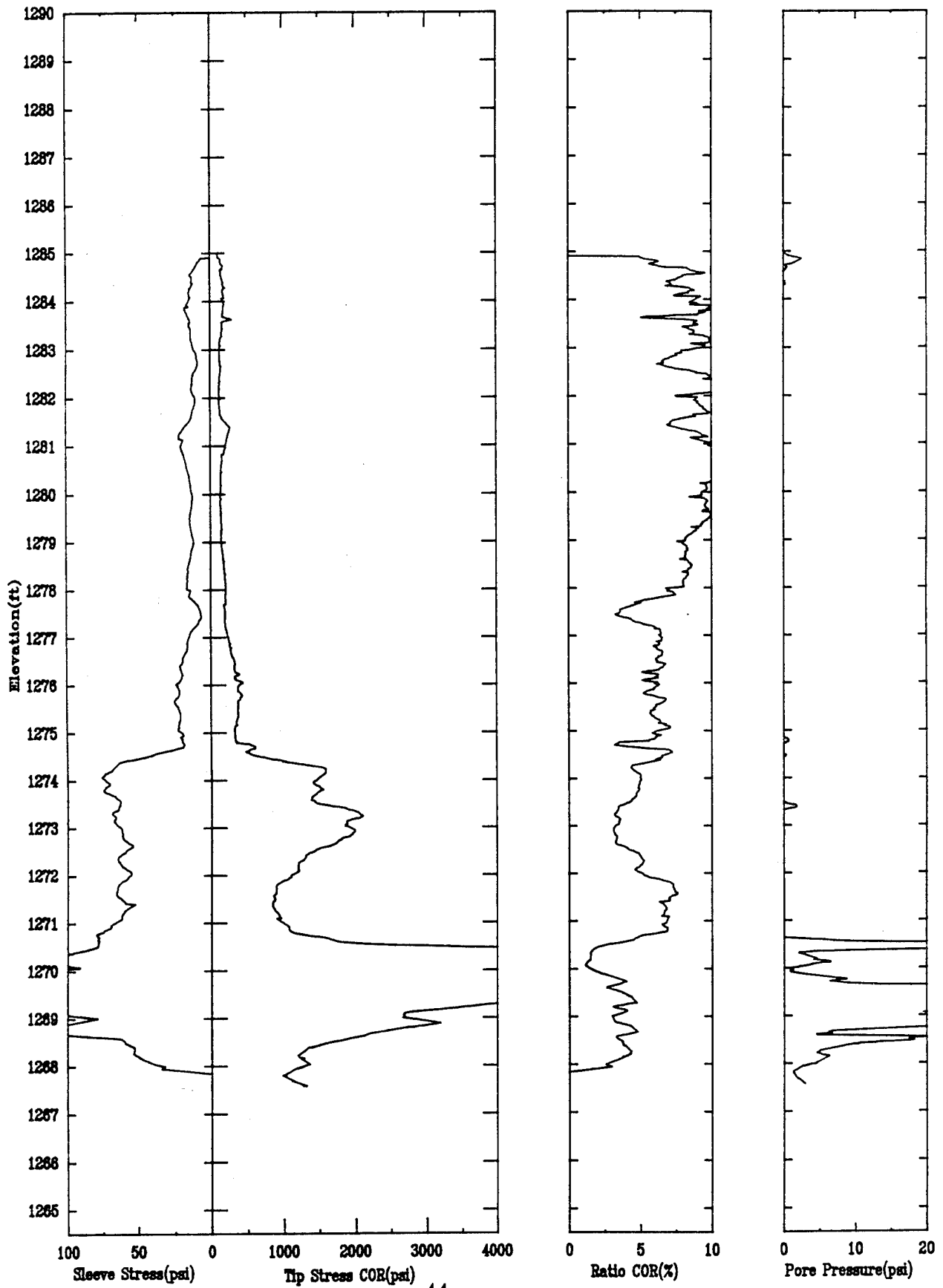
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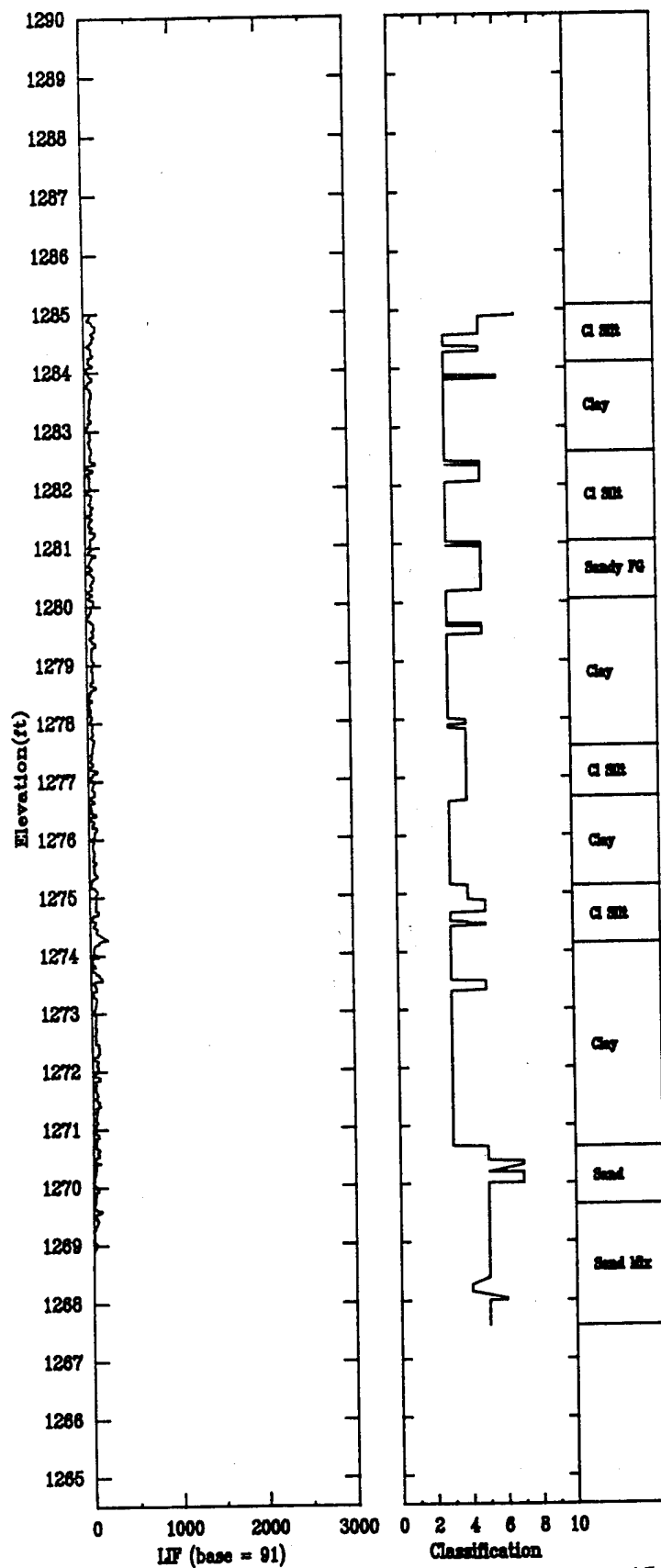
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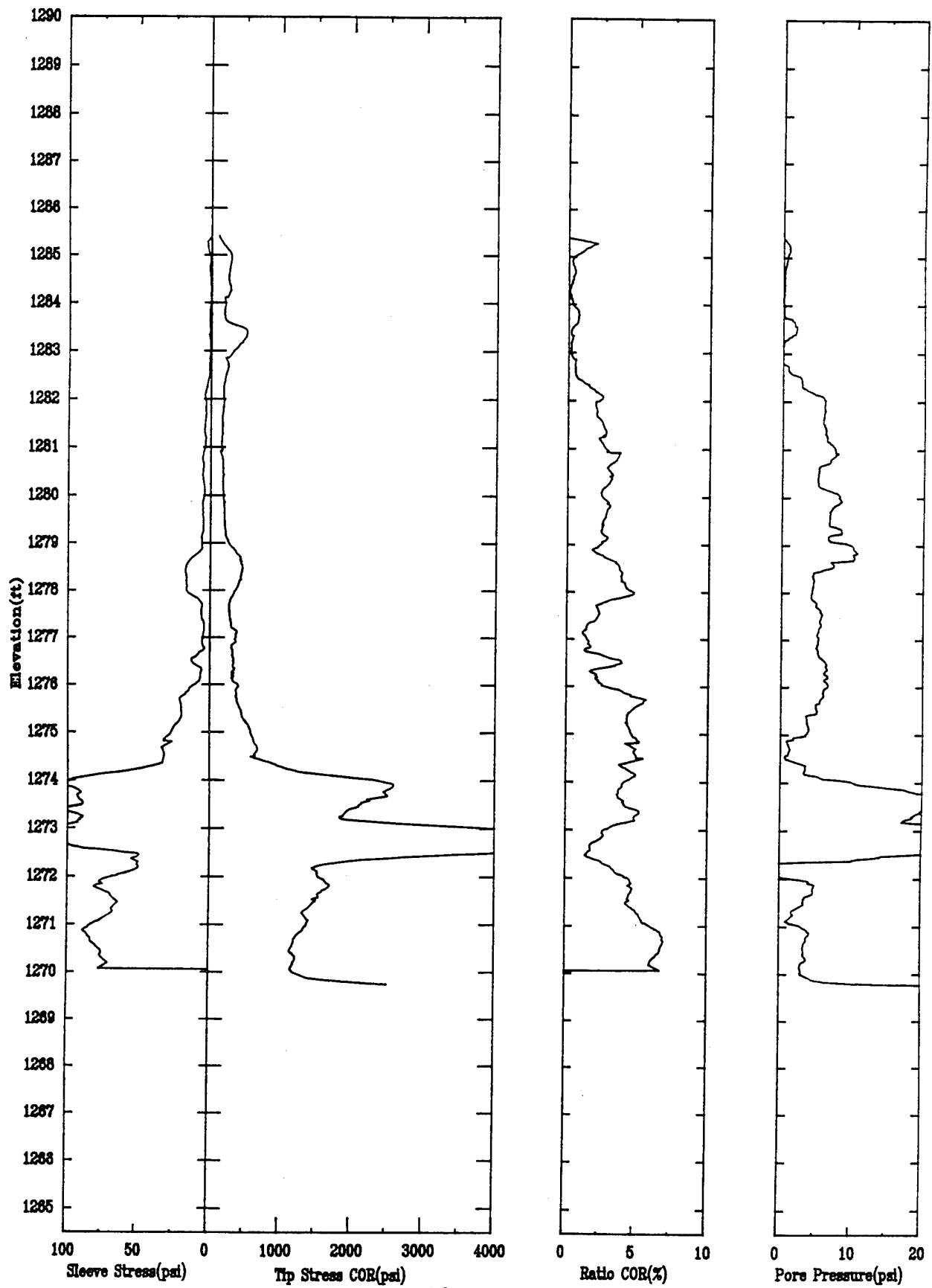
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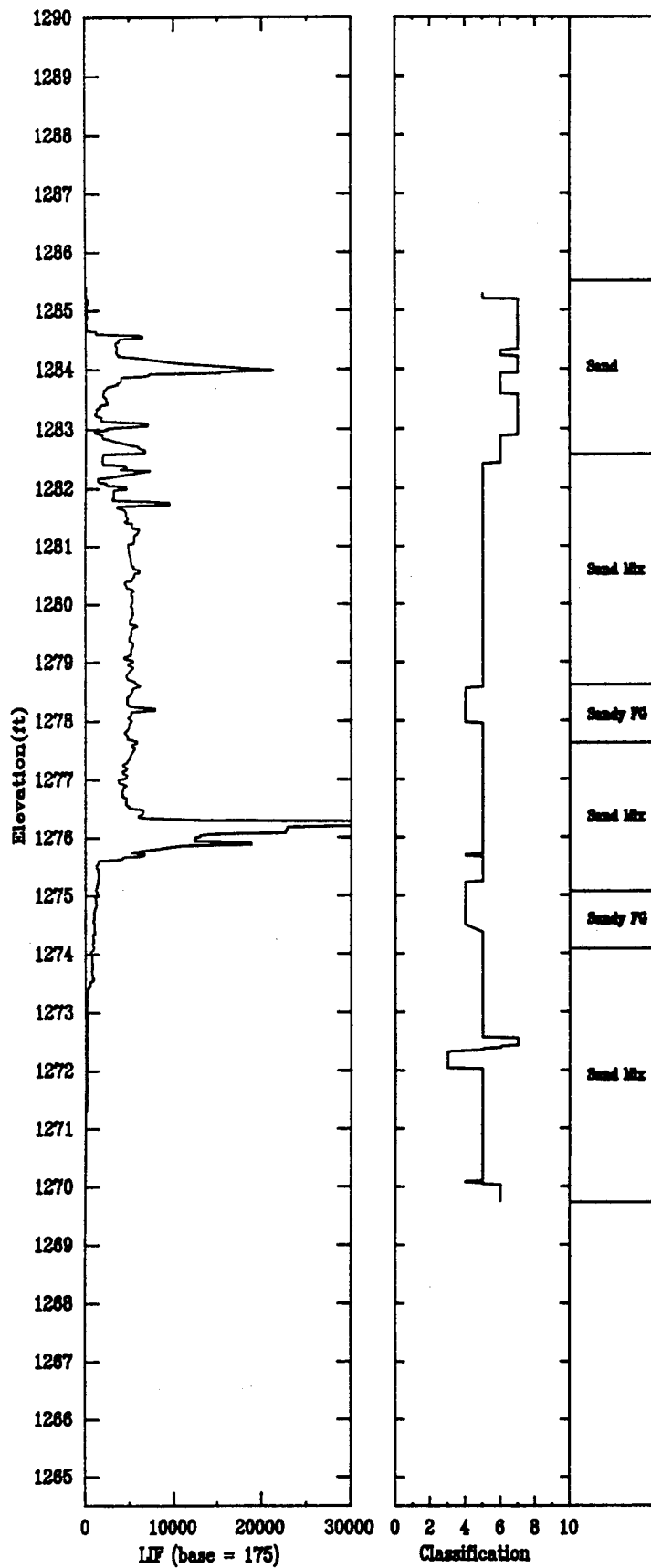
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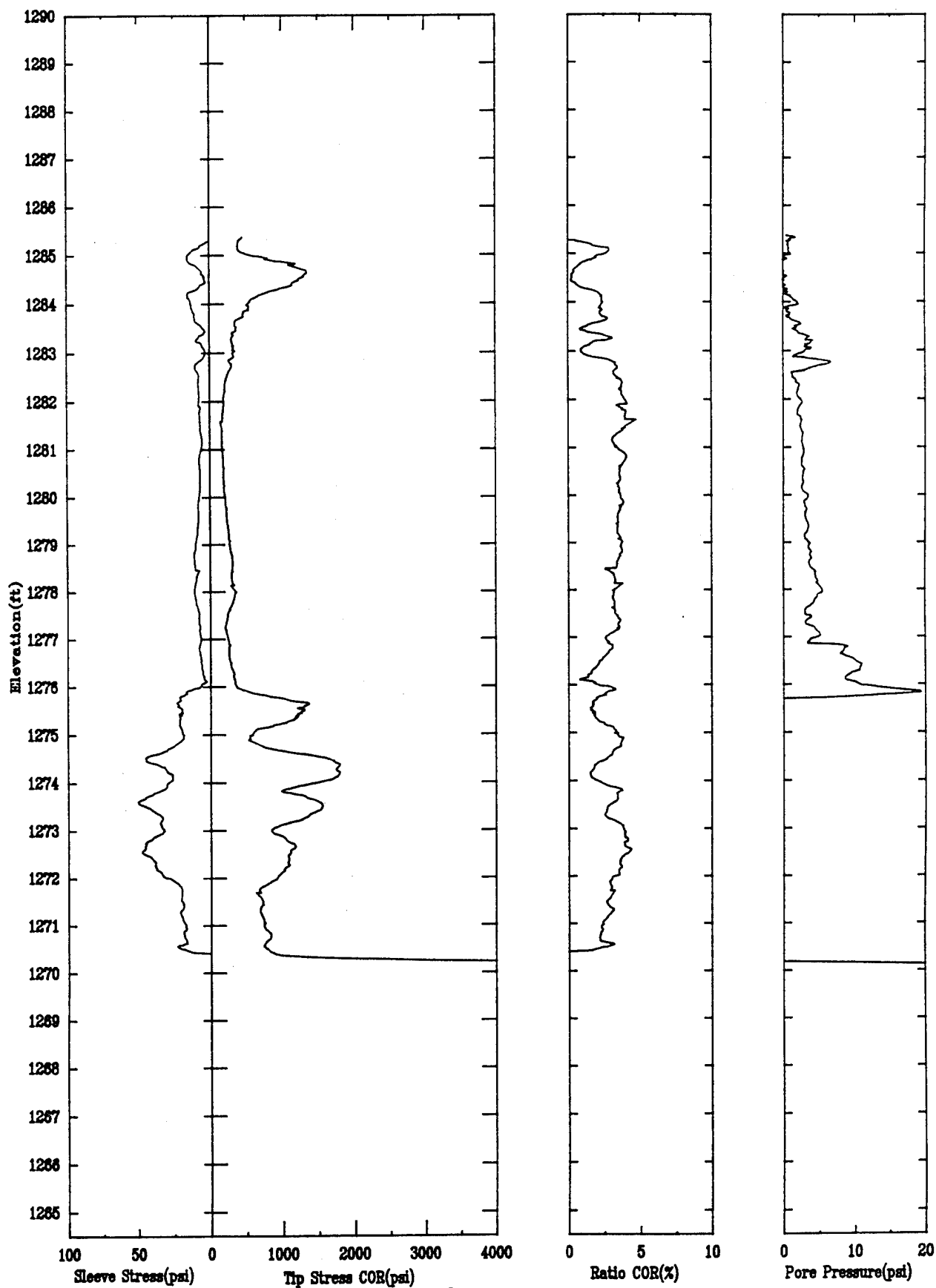
East 2185546.

Elevation 1285.1









FPA-12

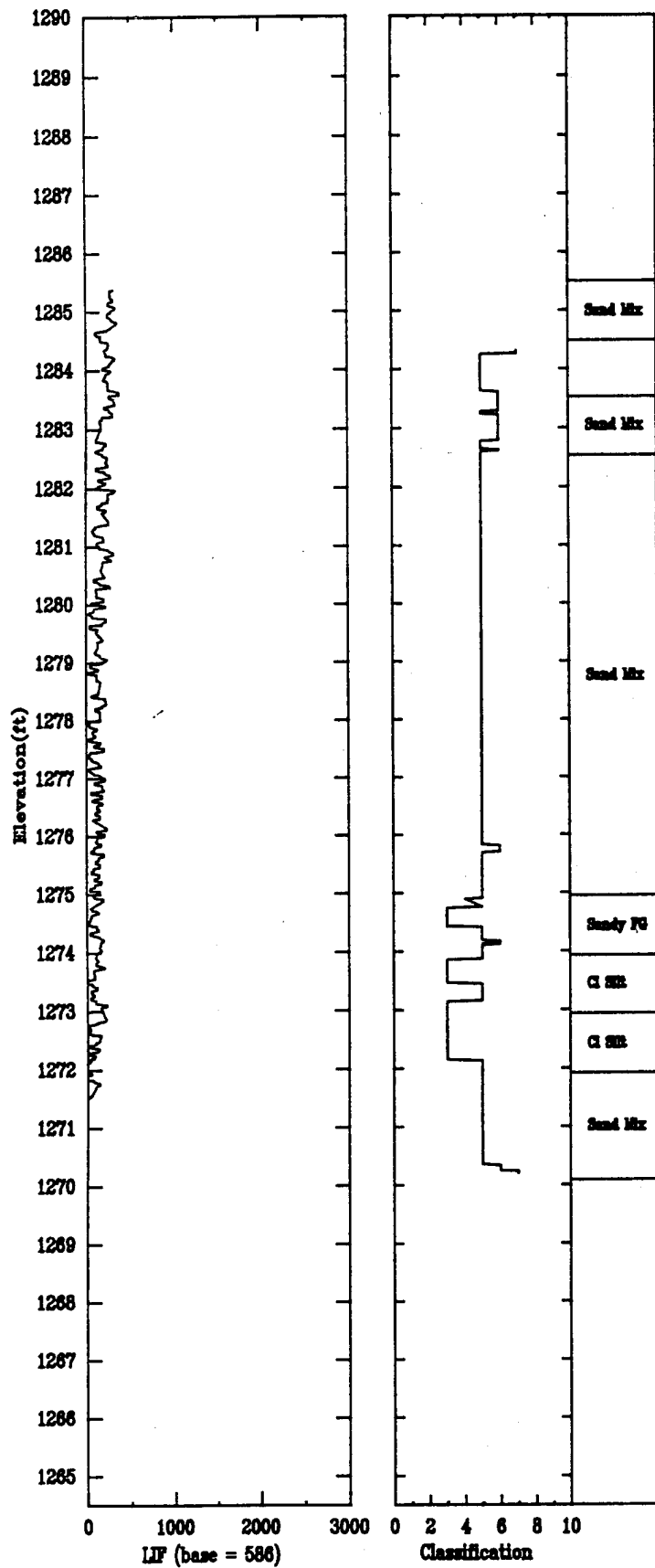
APPLIED RESEARCH ASSOCIATES, INC.

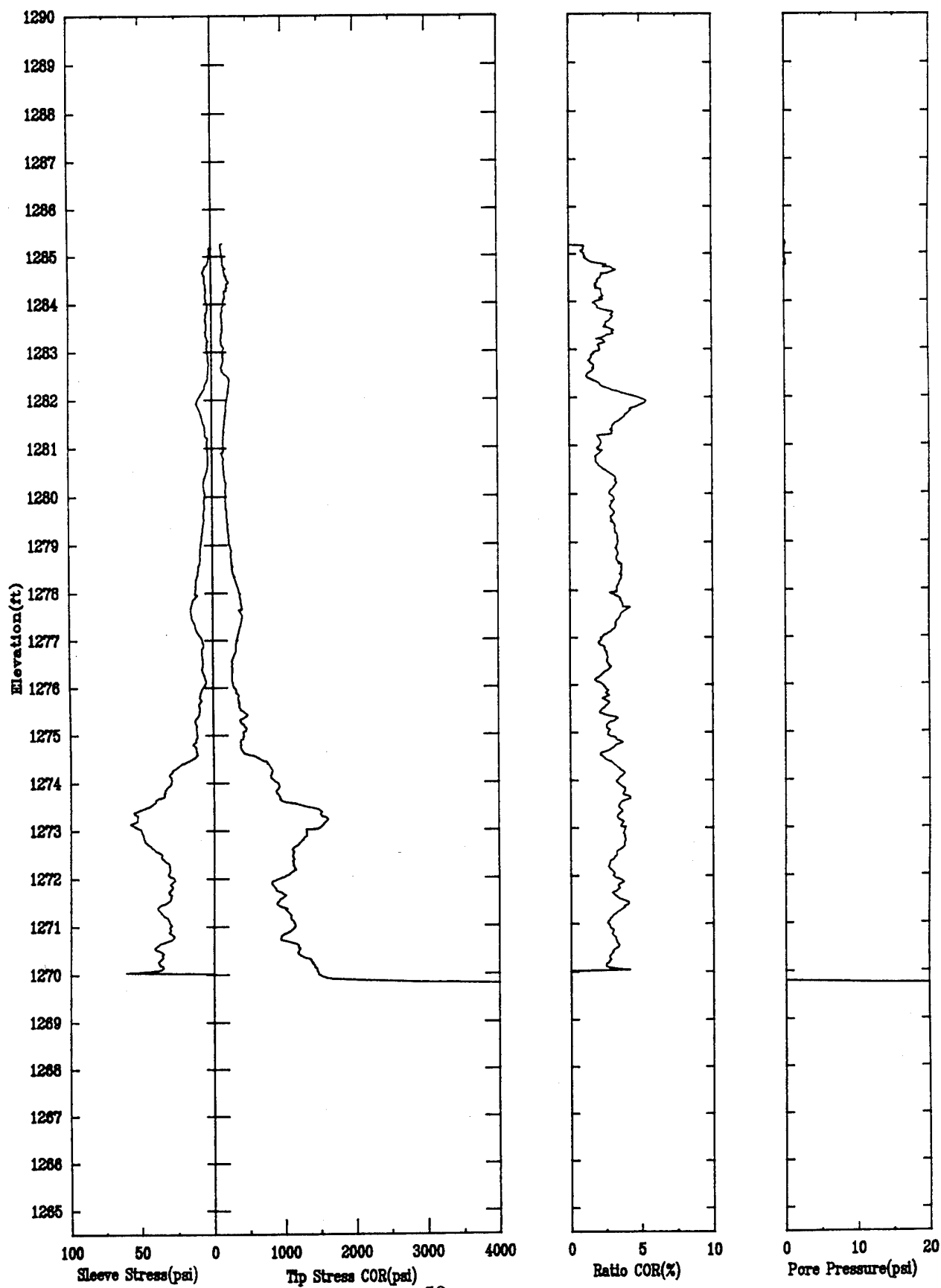
09/15/92

North 149421.

East 2185577.

Elevation 1285.5





FPA-13

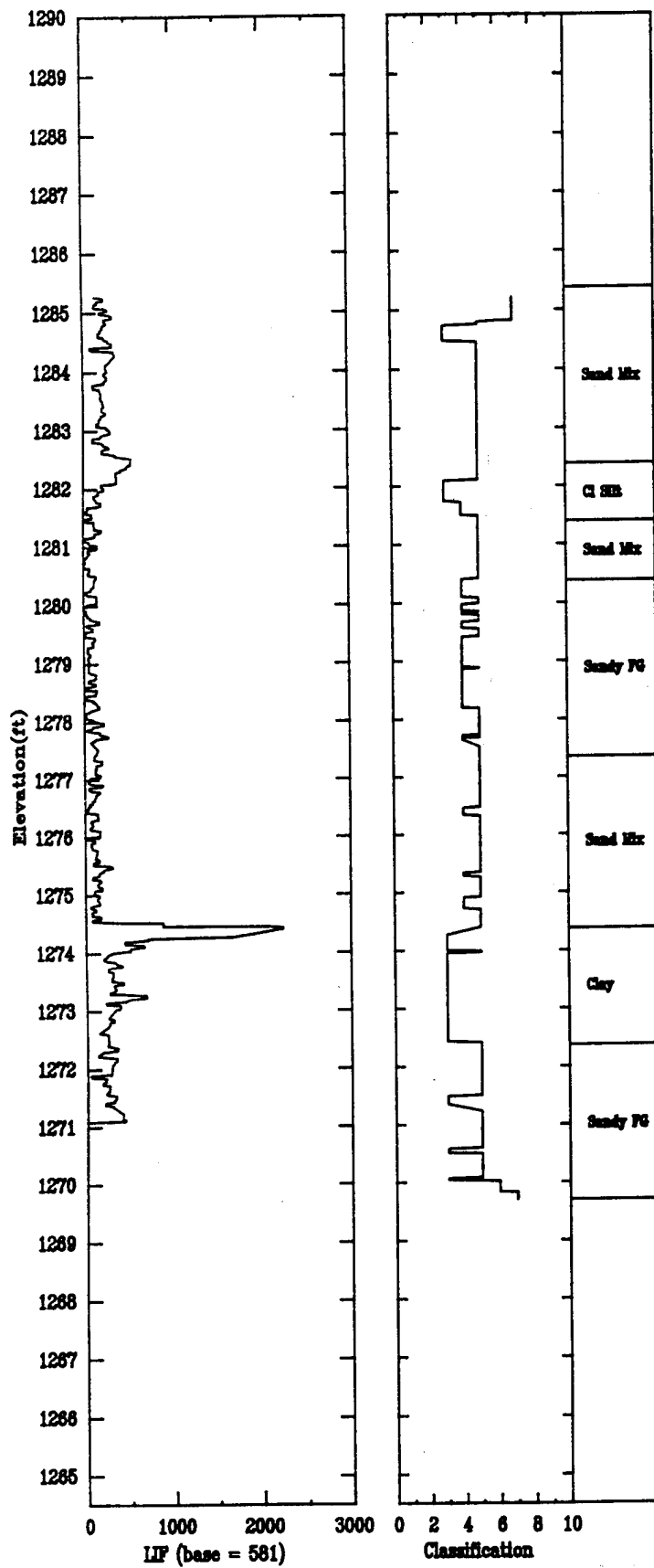
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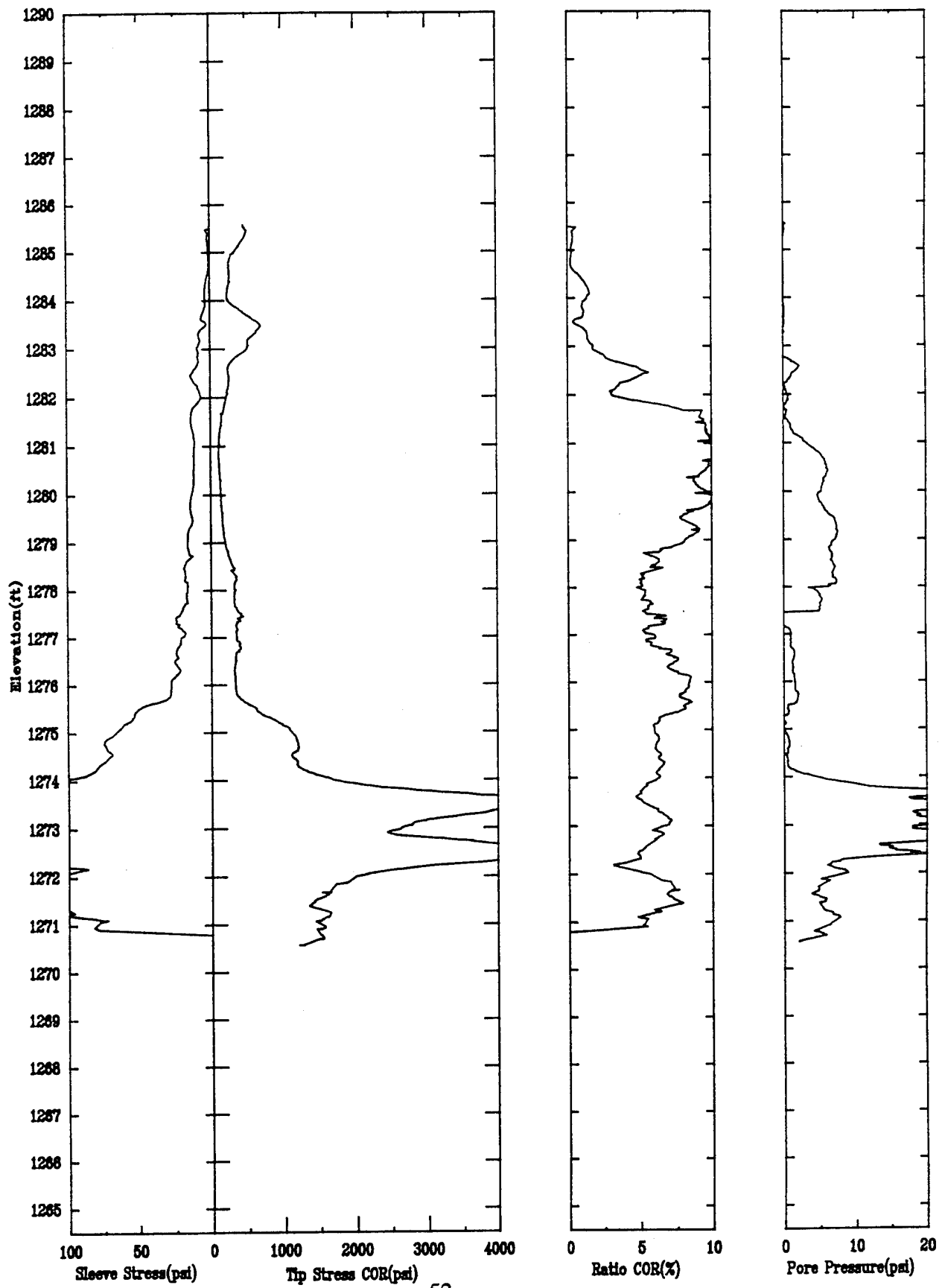
09/15/92

North 149421.

East 2185562.

Elevation 1285.4





FPA-14

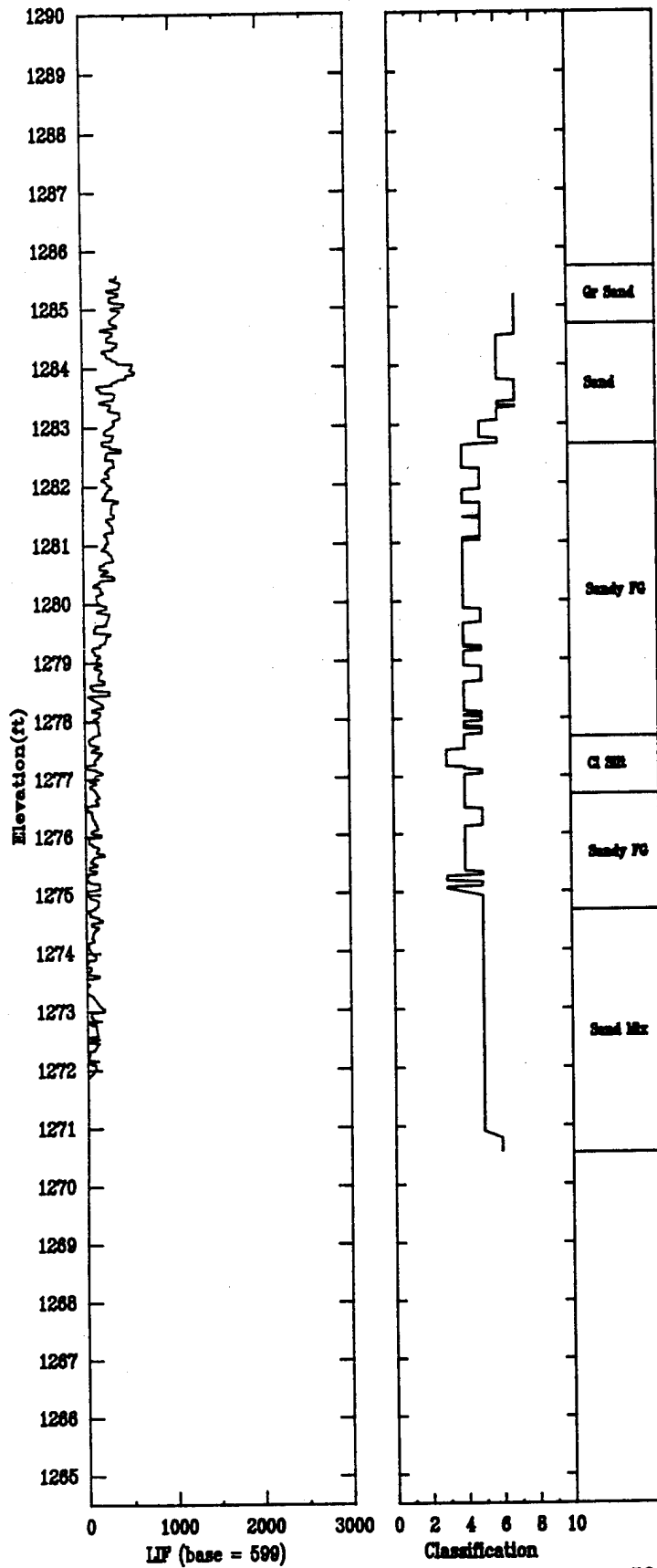
APPLIED RESEARCH ASSOCIATES, INC.

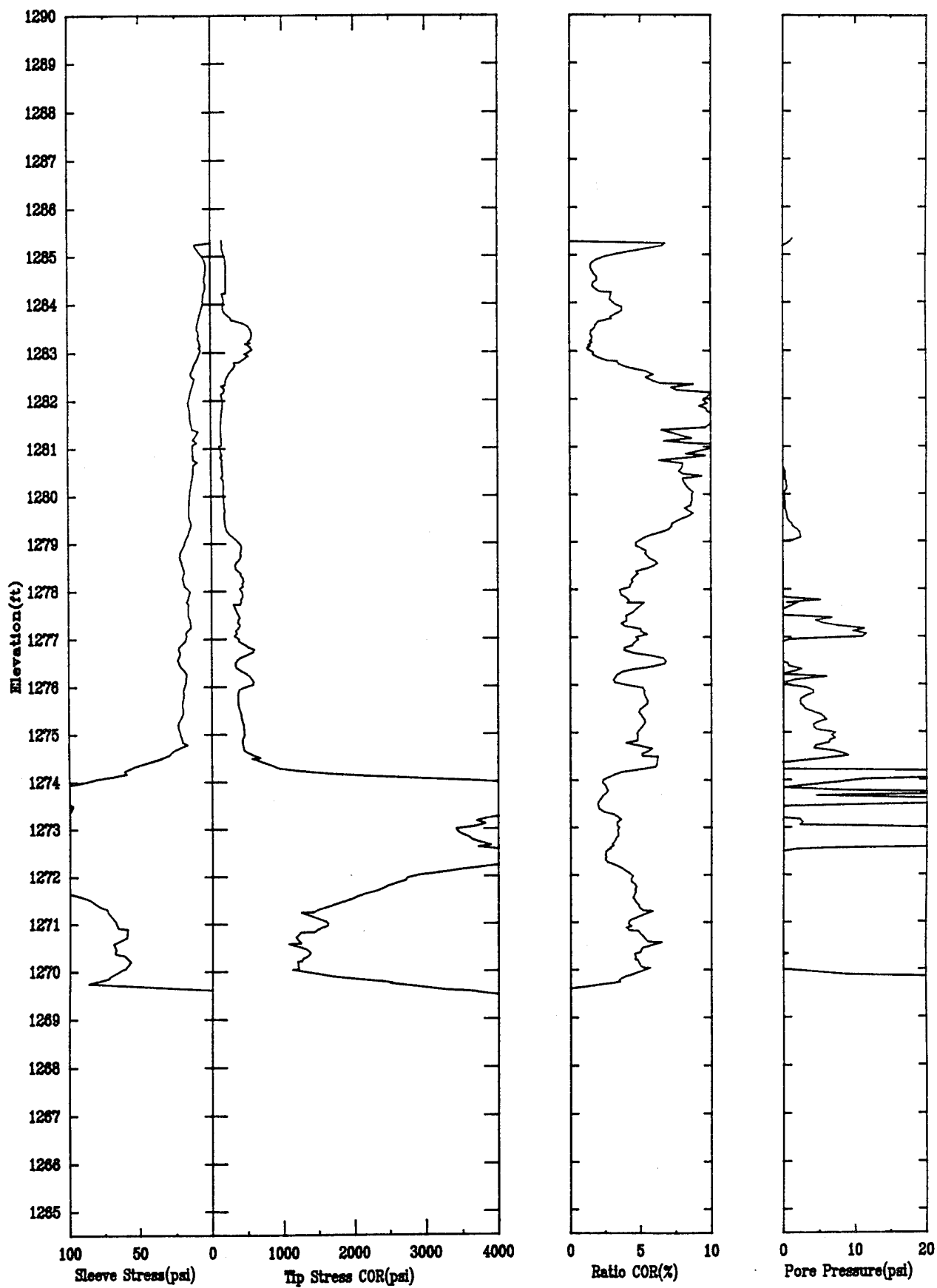
09/15/92

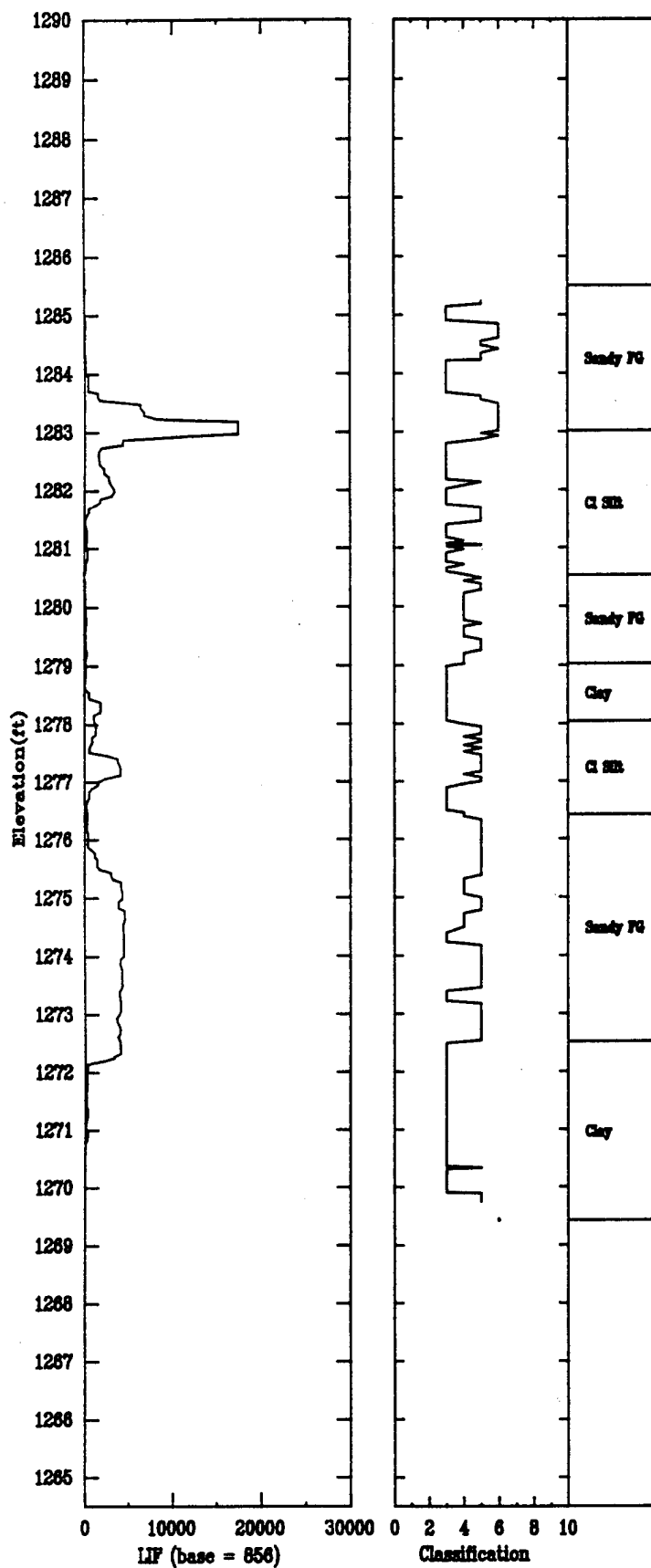
North 149419.

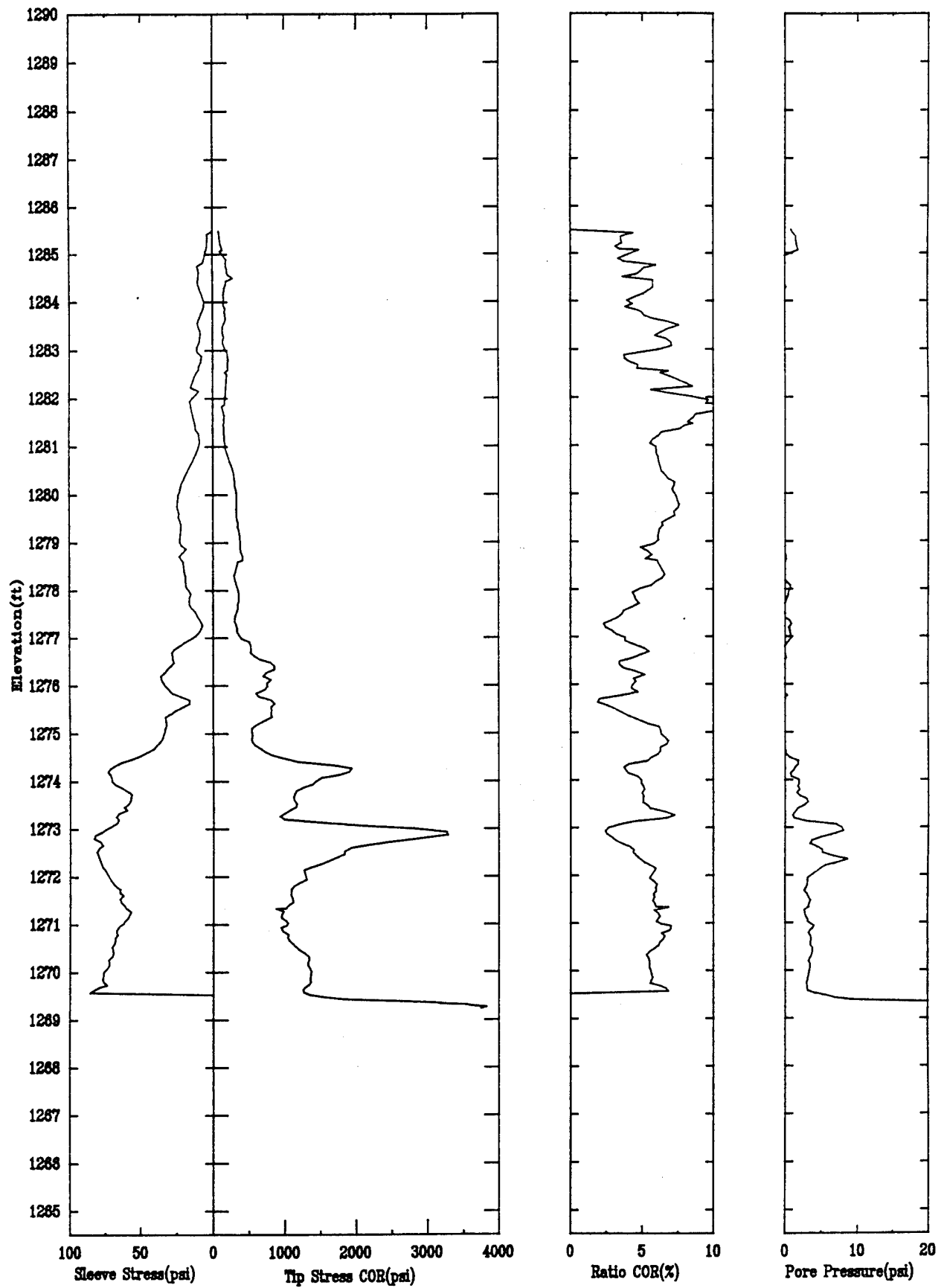
East 2185531.

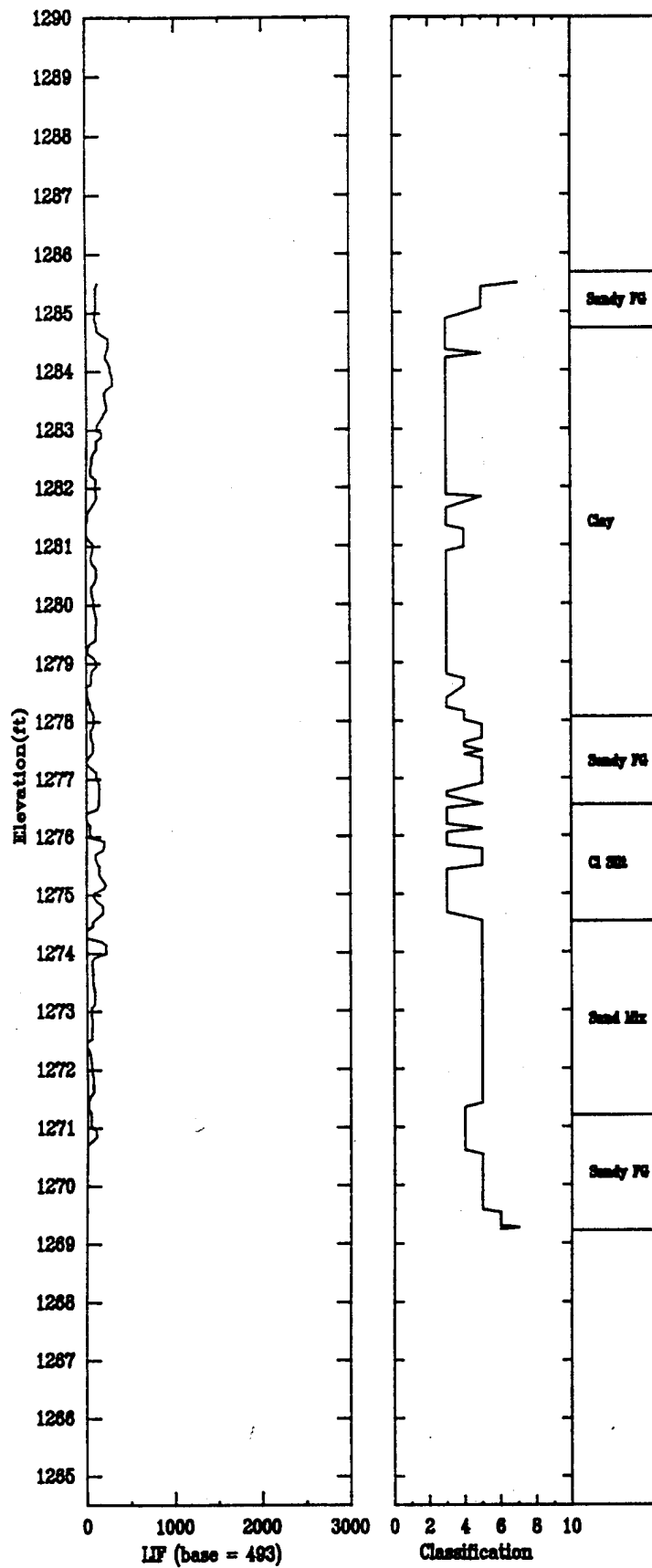
Elevation 1285.7

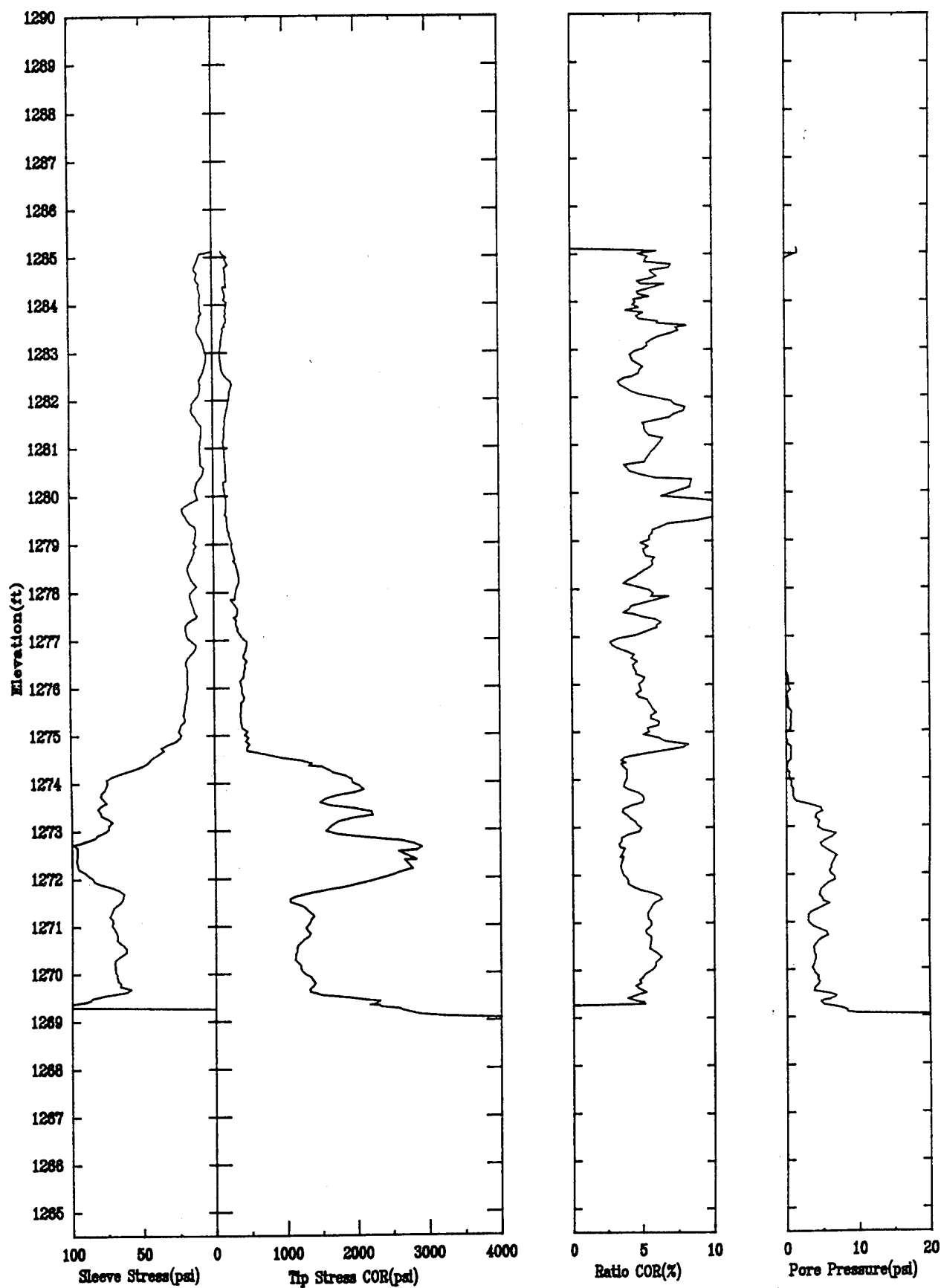


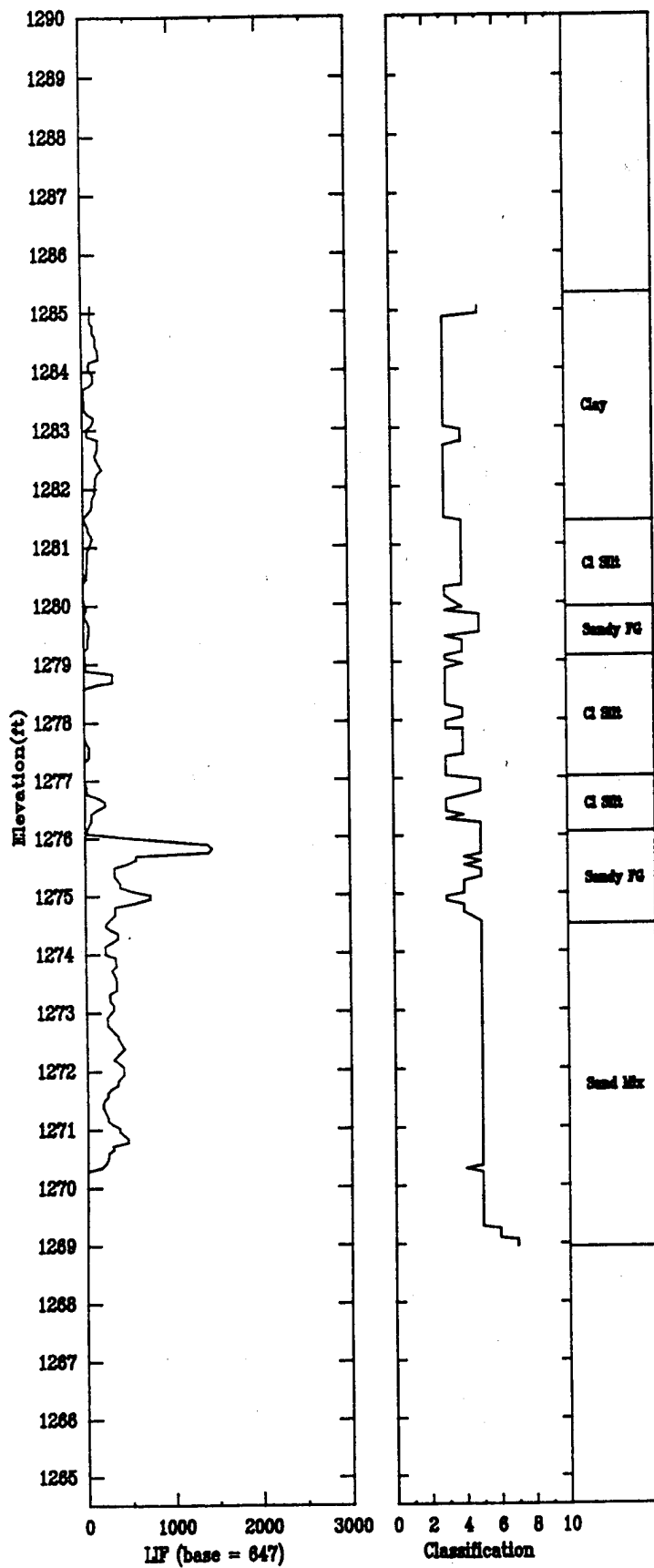


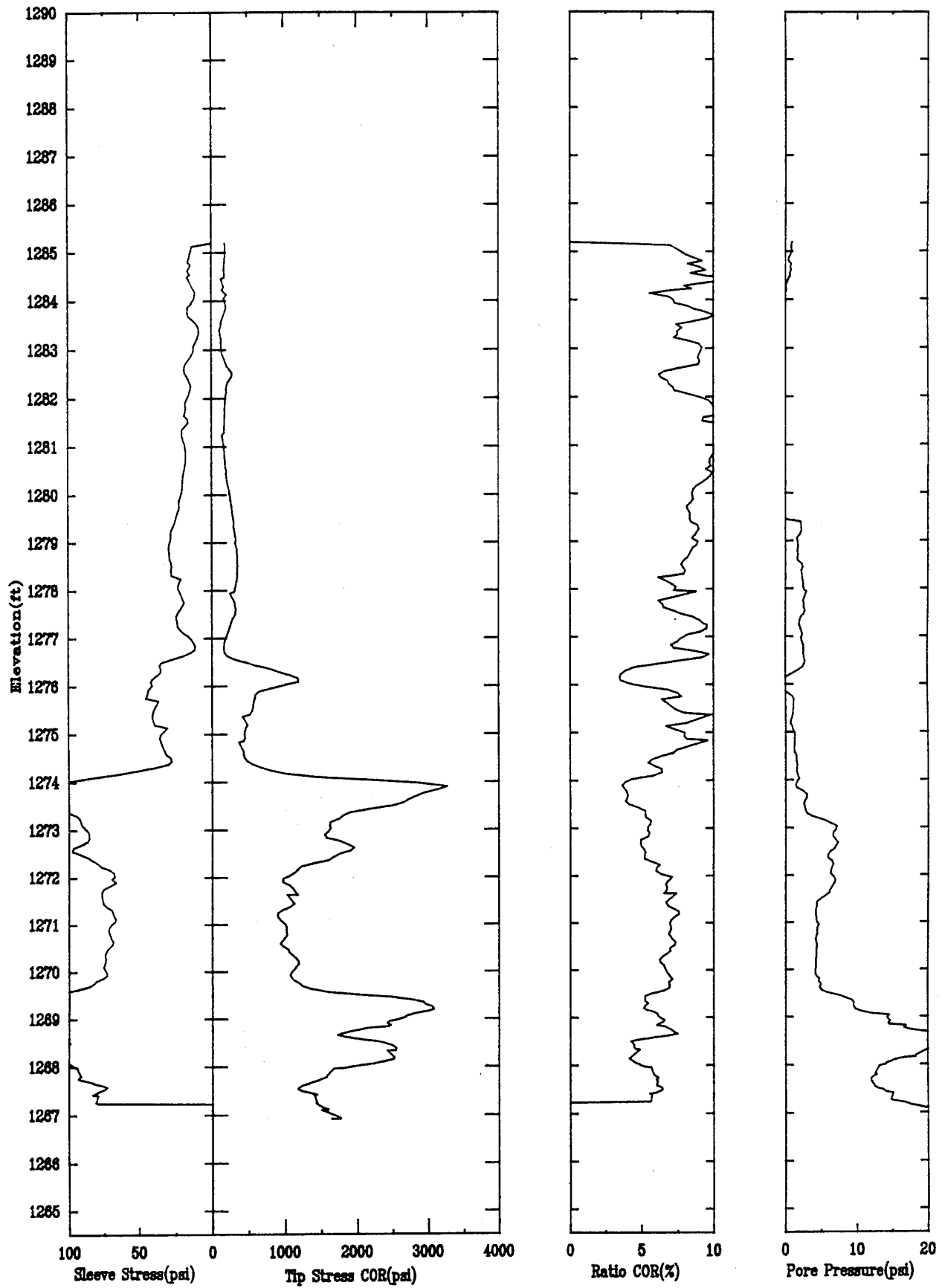












FPA-18

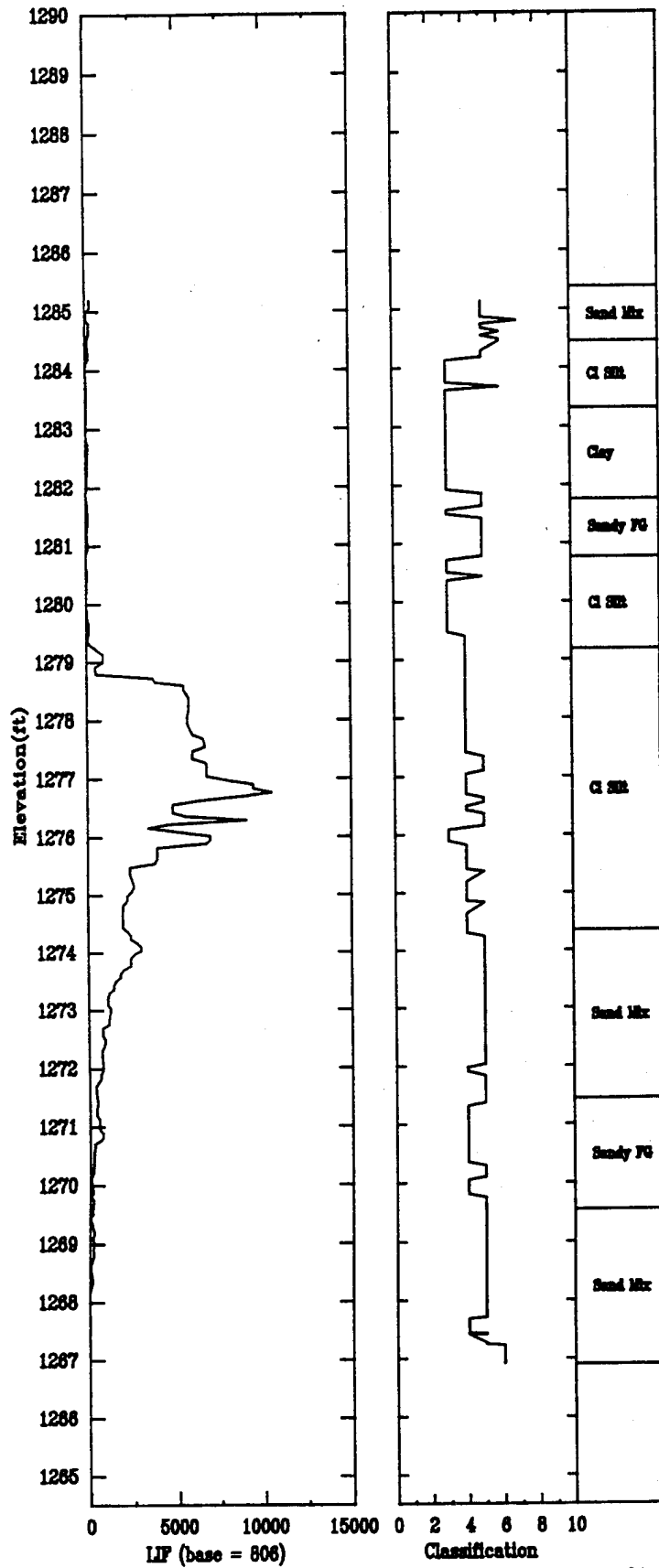
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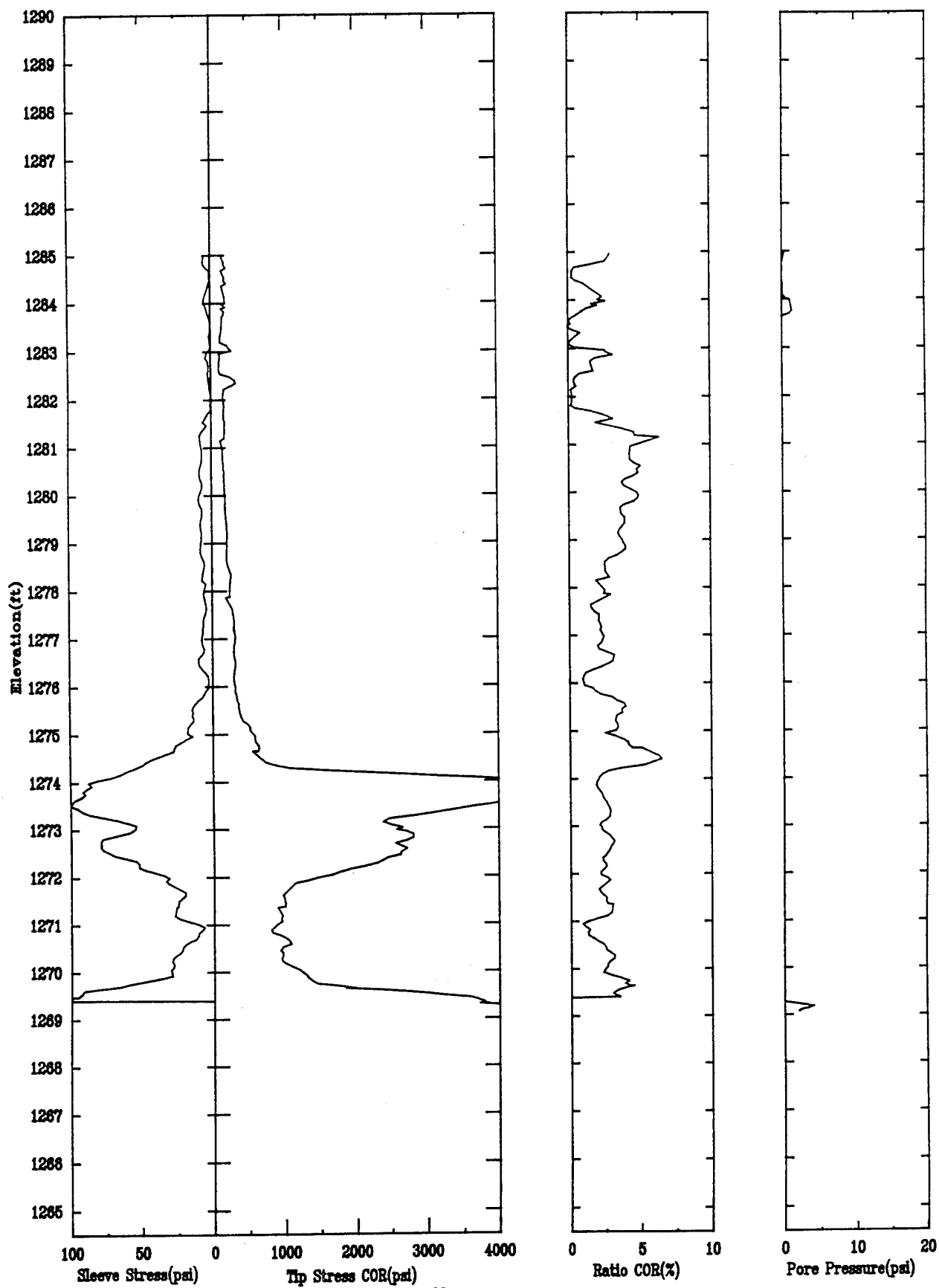
09/16/92

North 149420.

East 2185554.

Elevation 1285.4





FPA-19

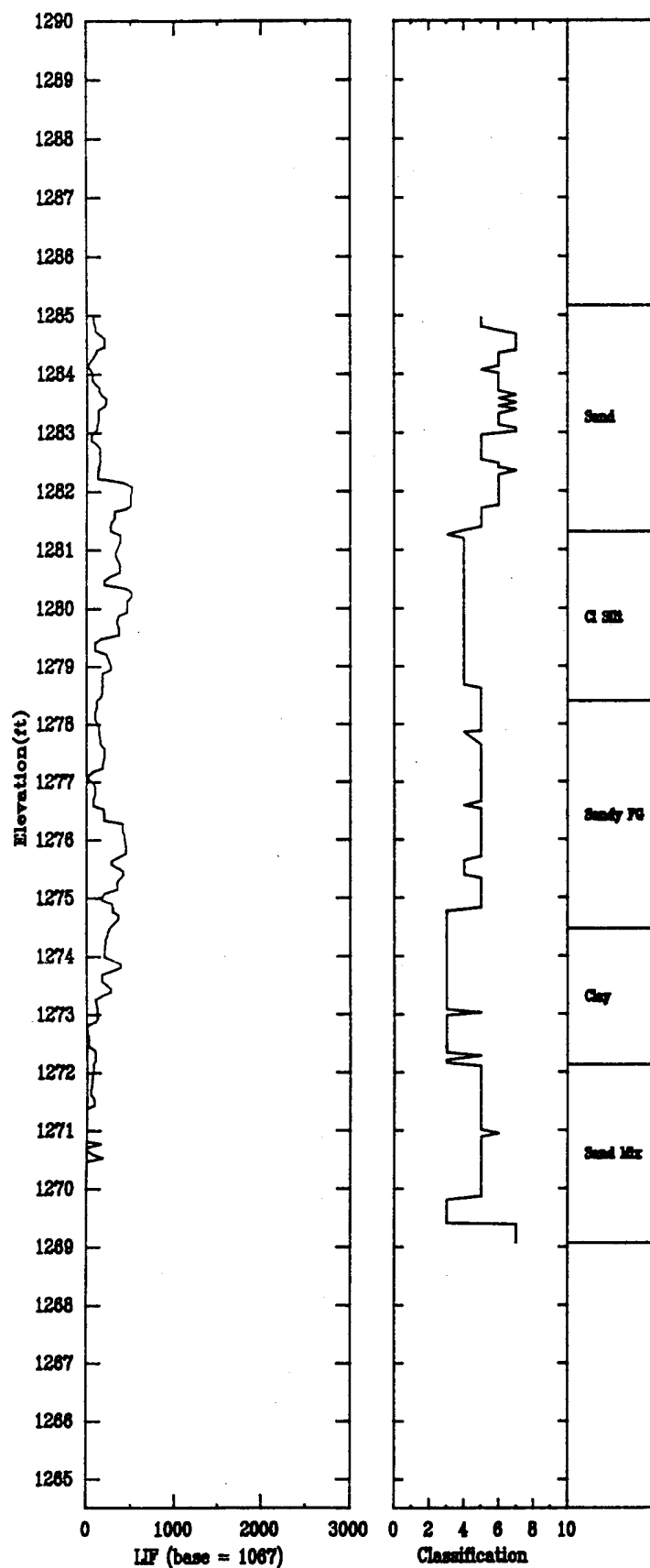
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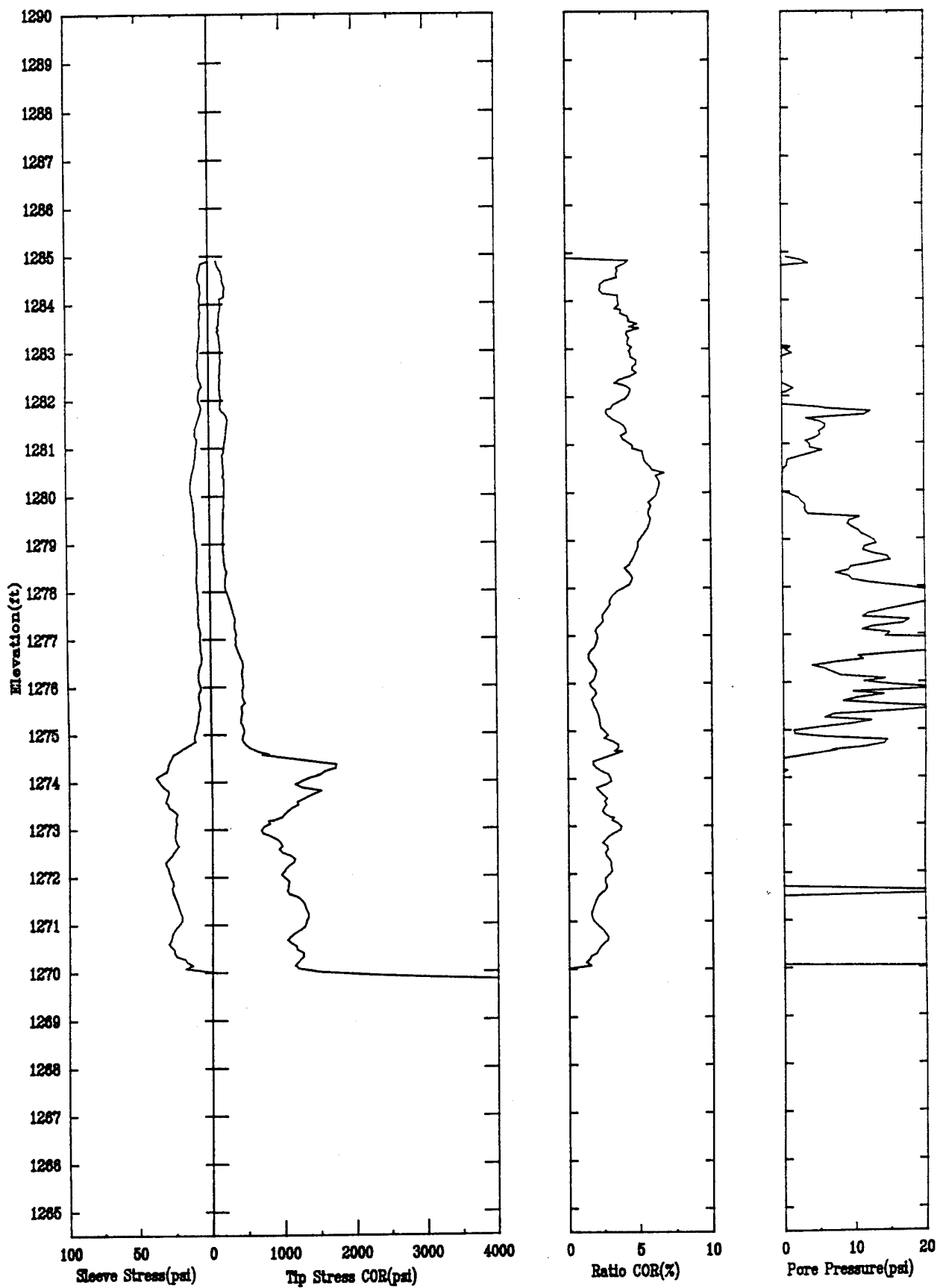
09/16/92

North 149400.

East 218554.

Elevation 1285.2





FPA-20

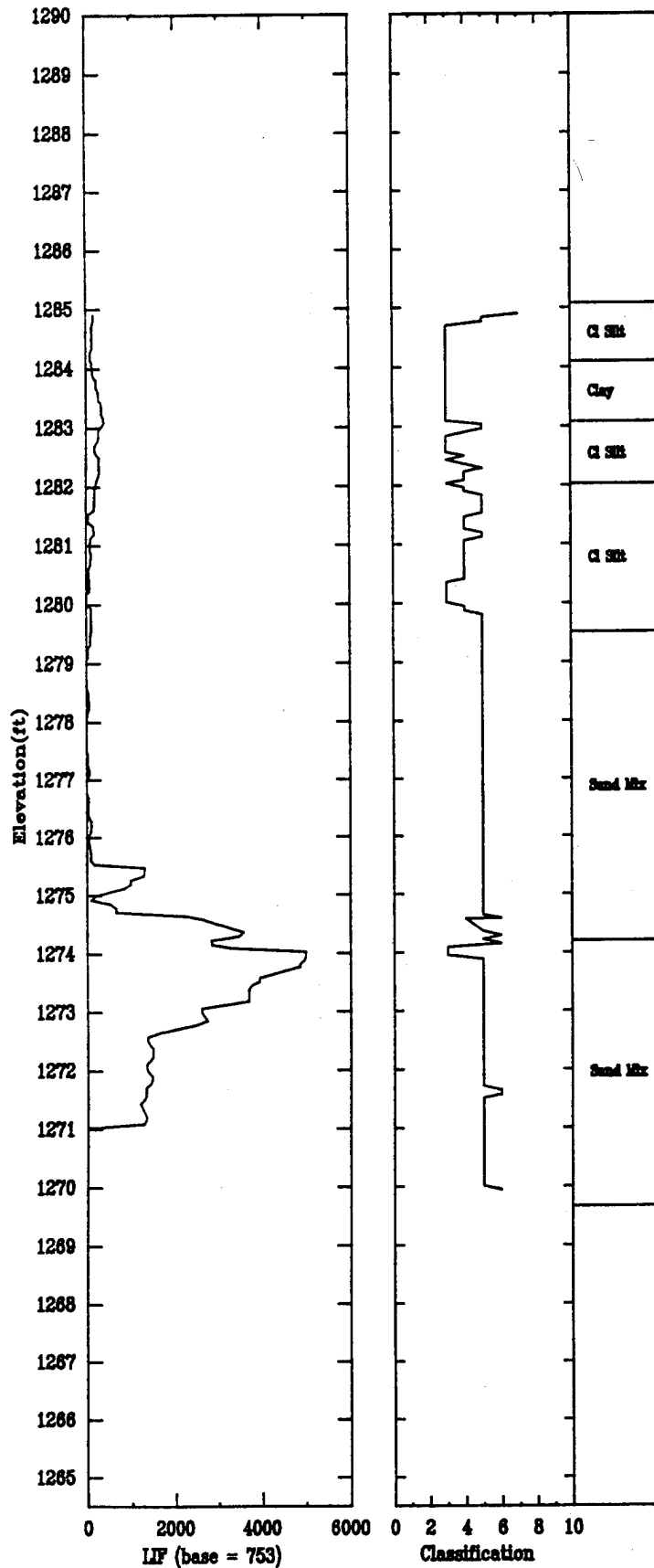
APPLIED RESEARCH ASSOCIATES, INC.

09/16/92

North 149380.

East 218554.

Elevation 1285.1





FPA-21

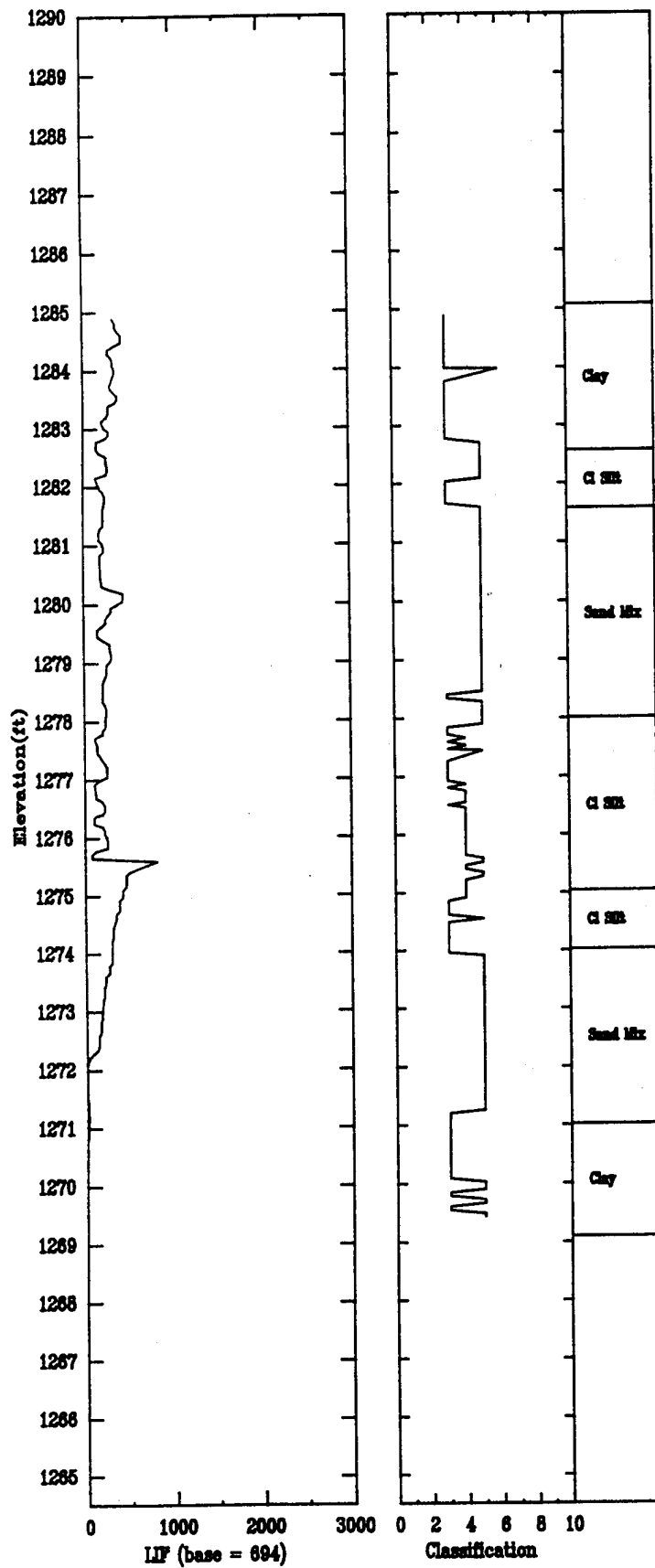
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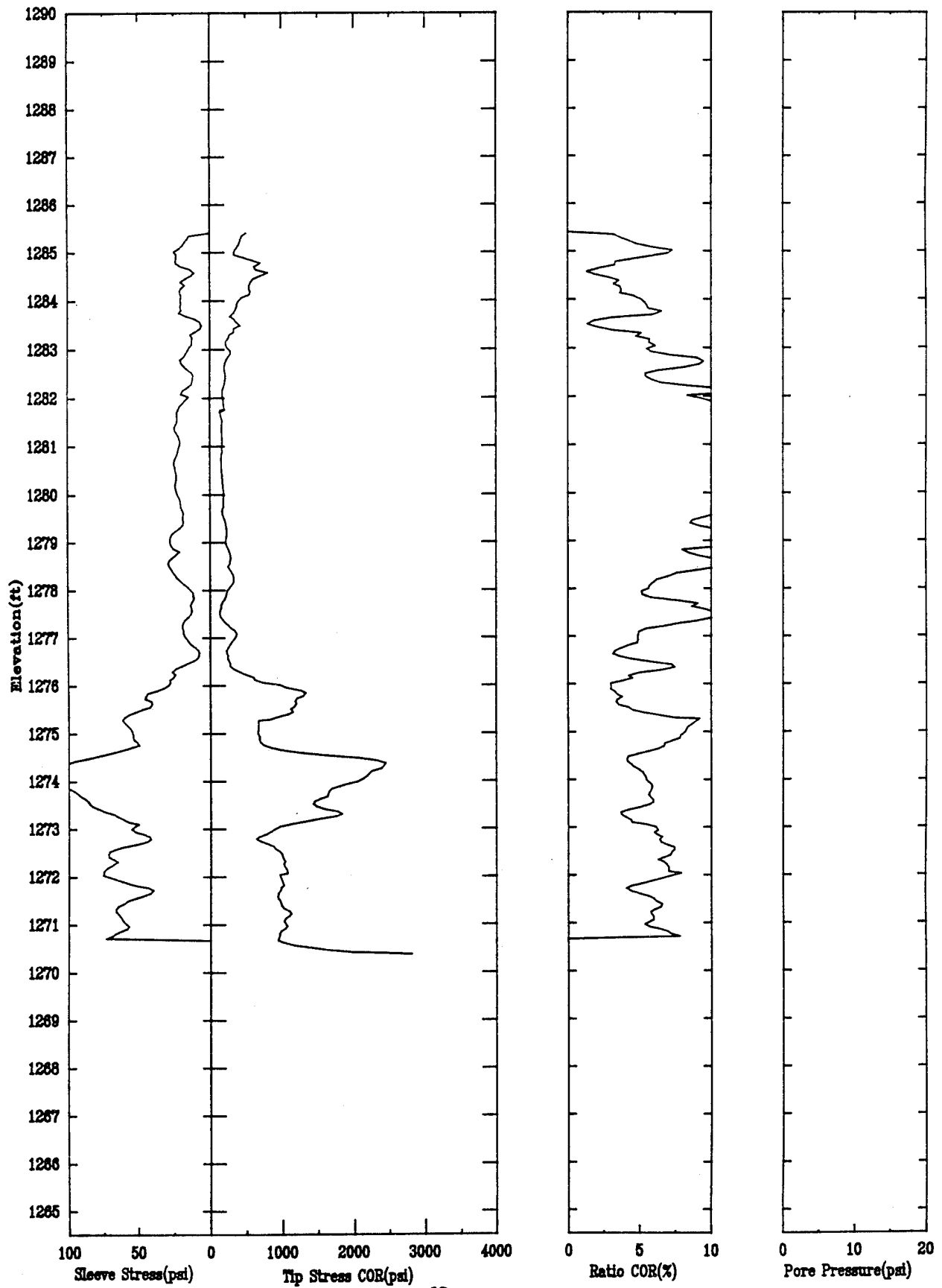
09/16/92

North 149390.

East 2185554.

Elevation 1285.1





FPA-22

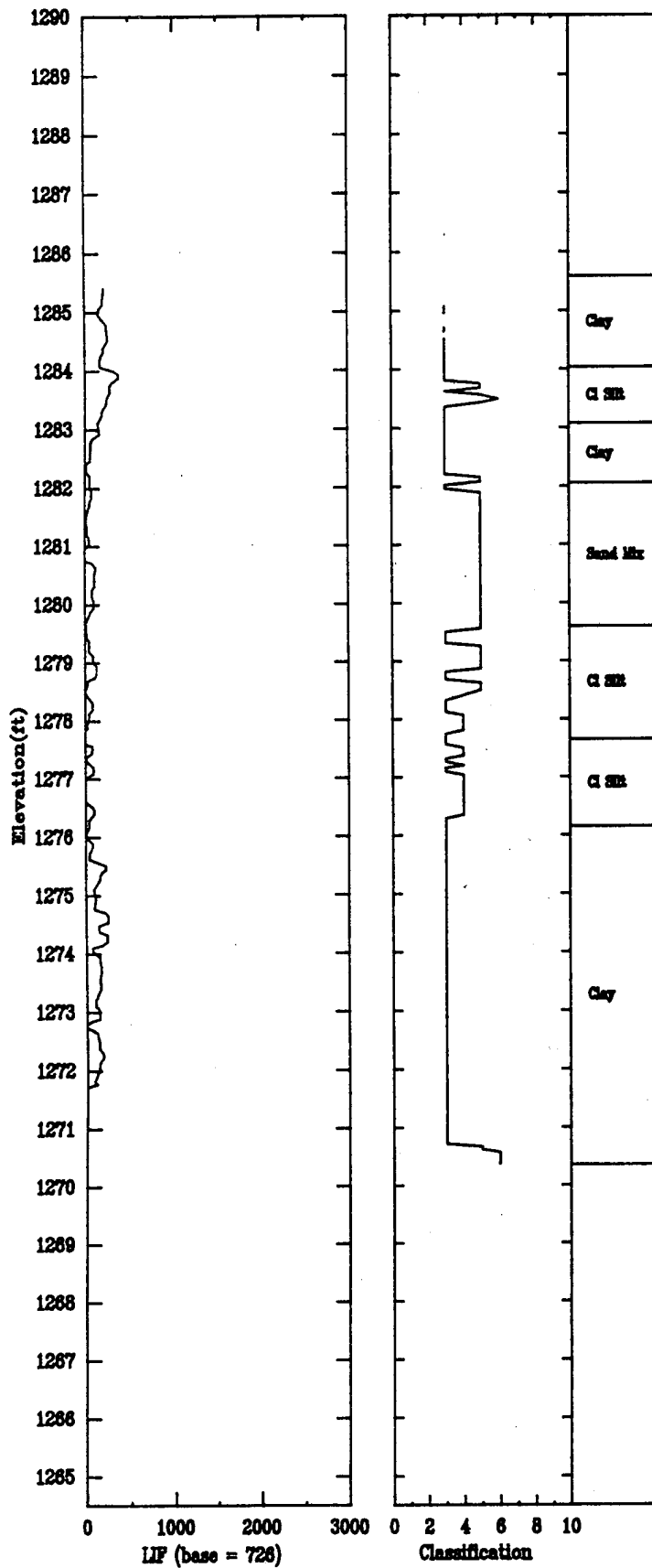
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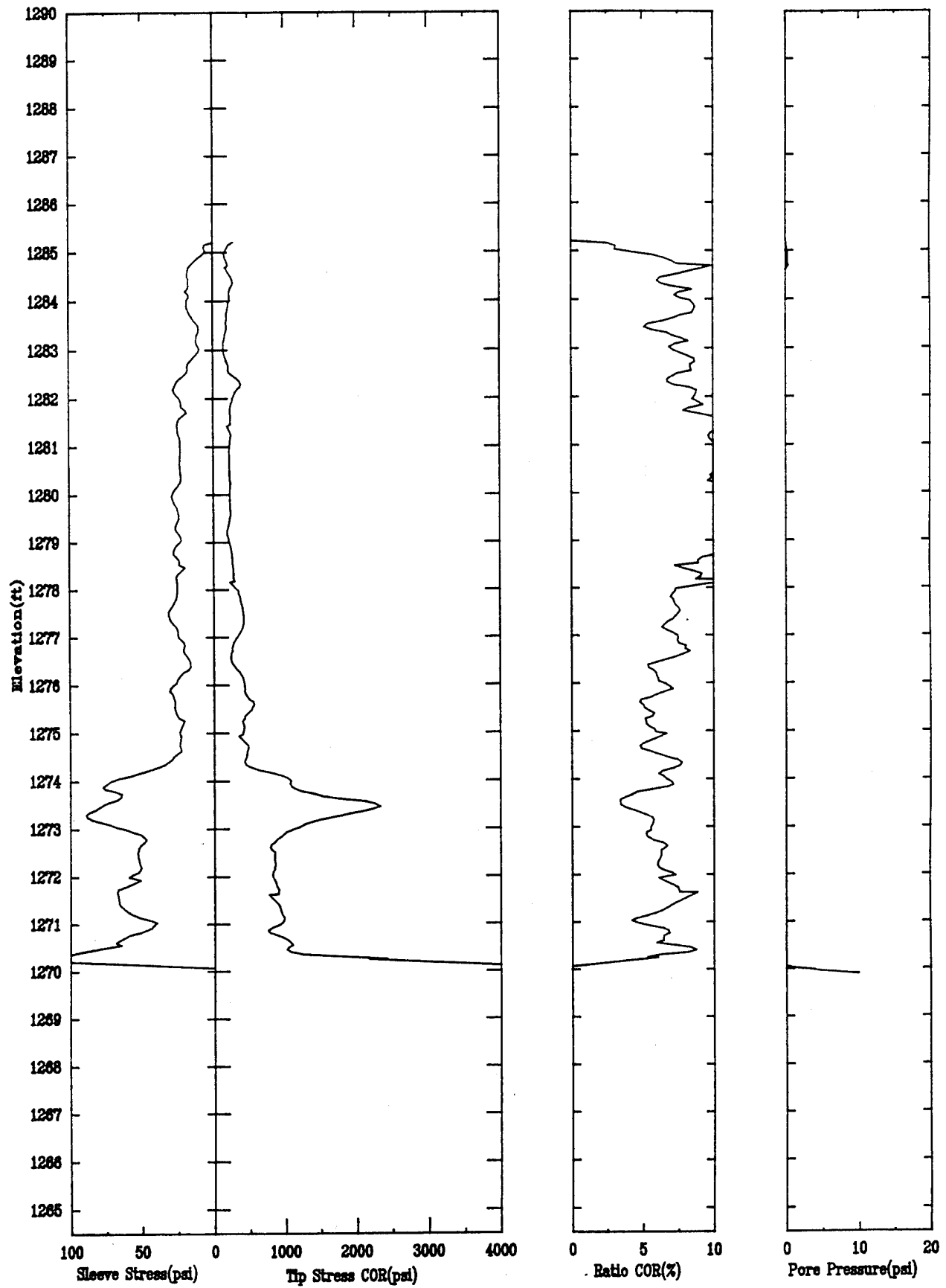
09/16/92

North 149431.

East 2185571.

Elevation 1285.6





FPA-23

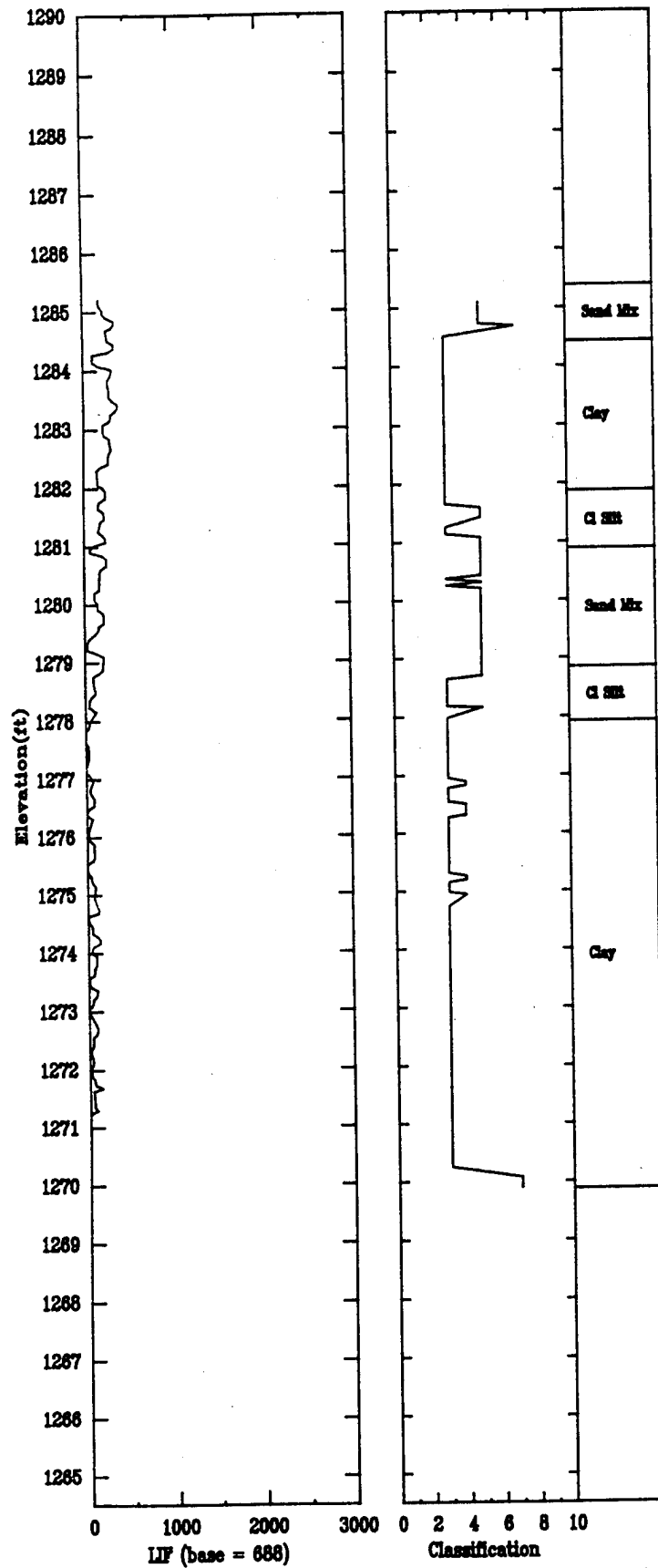
APPLIED RESEARCH ASSOCIATES, INC.

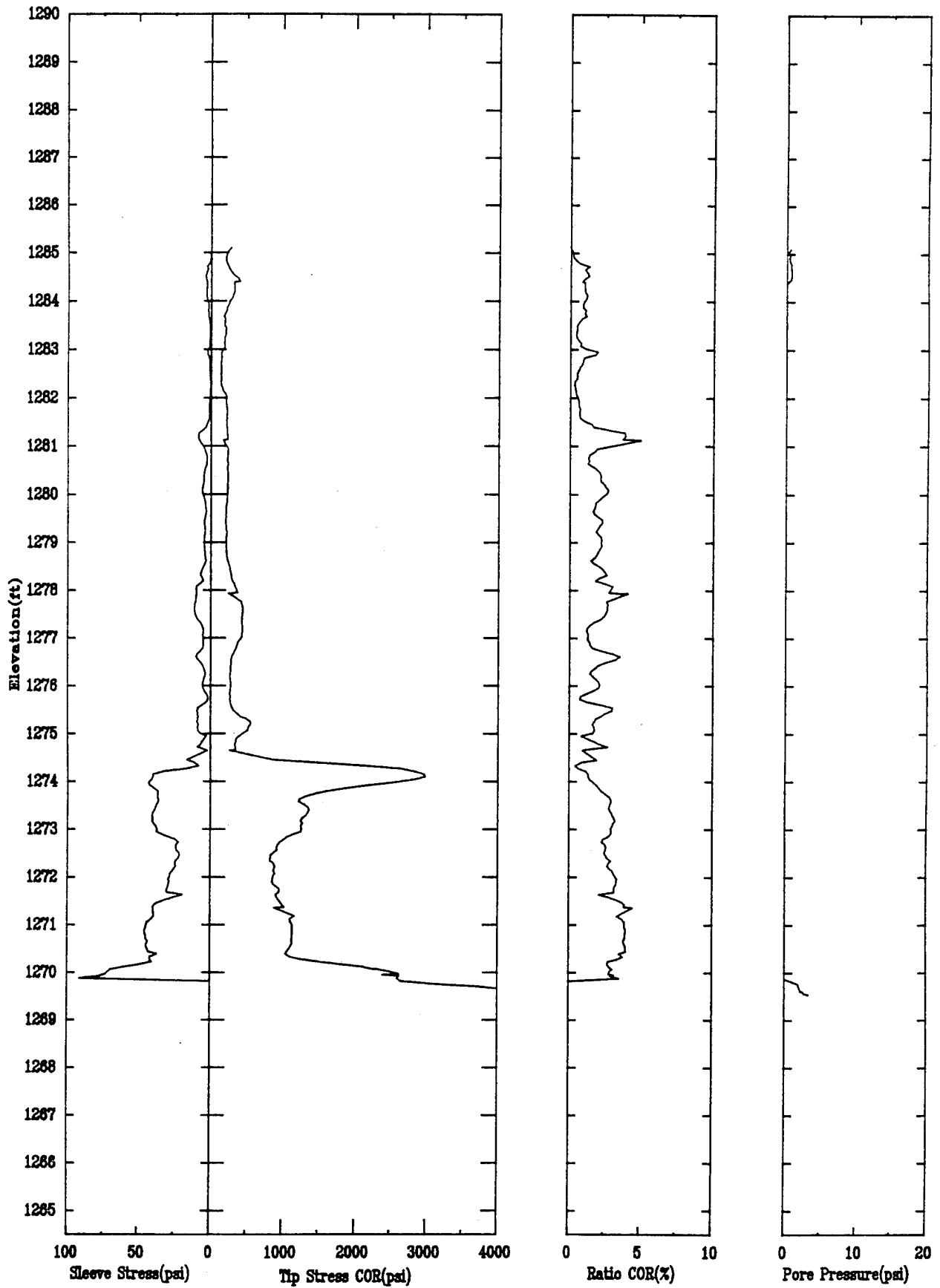
09/16/92

North 149411.

East 2185570.

Elevation 1285.4





FPA-24

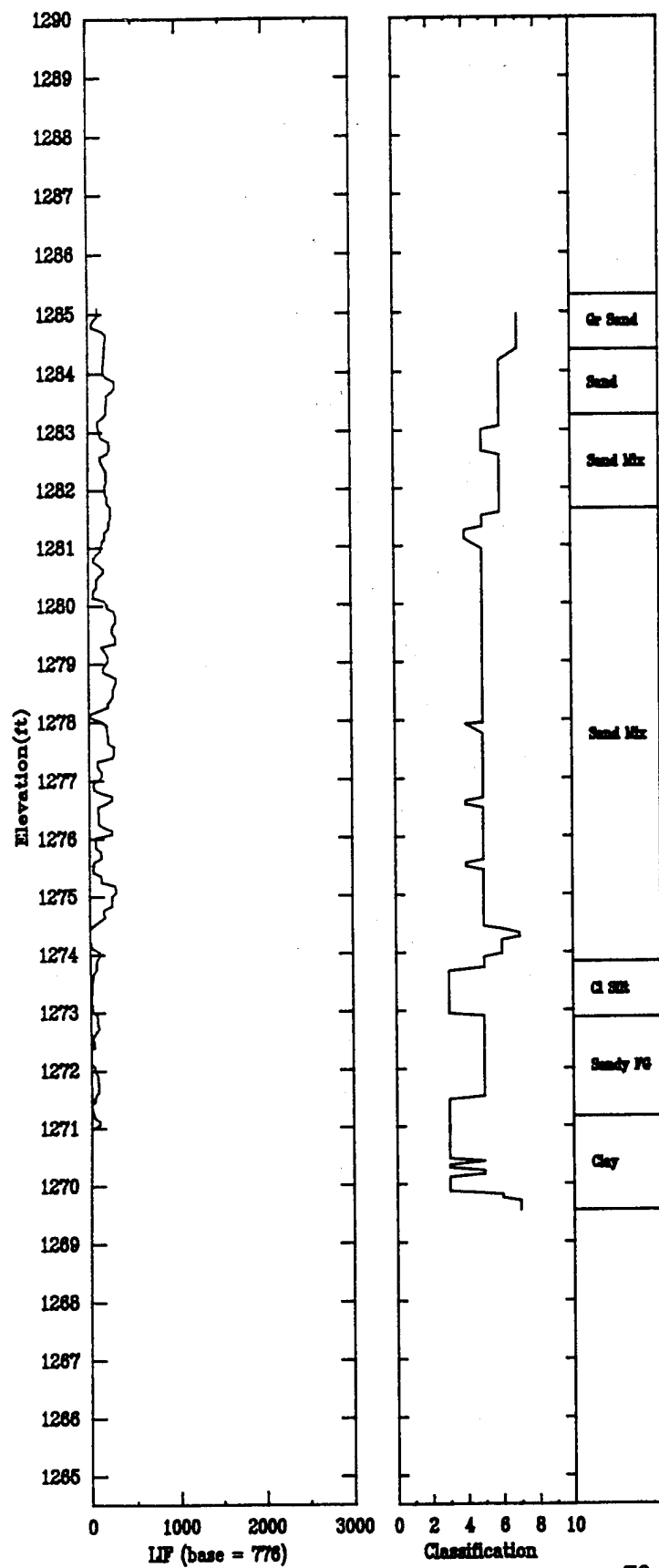
APPLIED RESEARCH ASSOCIATES, INC.

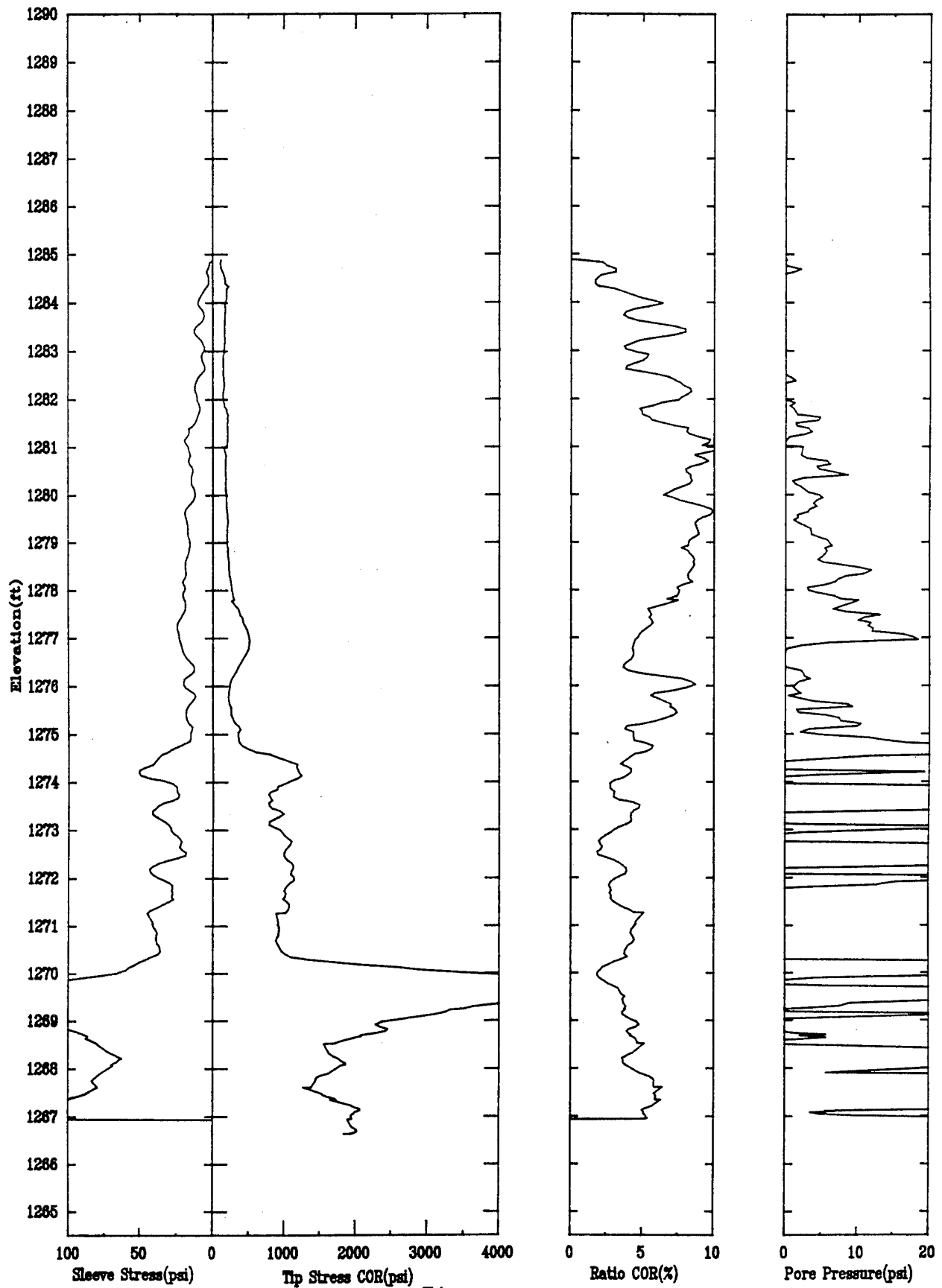
09/16/92

North 149391.

East 2185569.

Elevation 1285.3





FPA-25

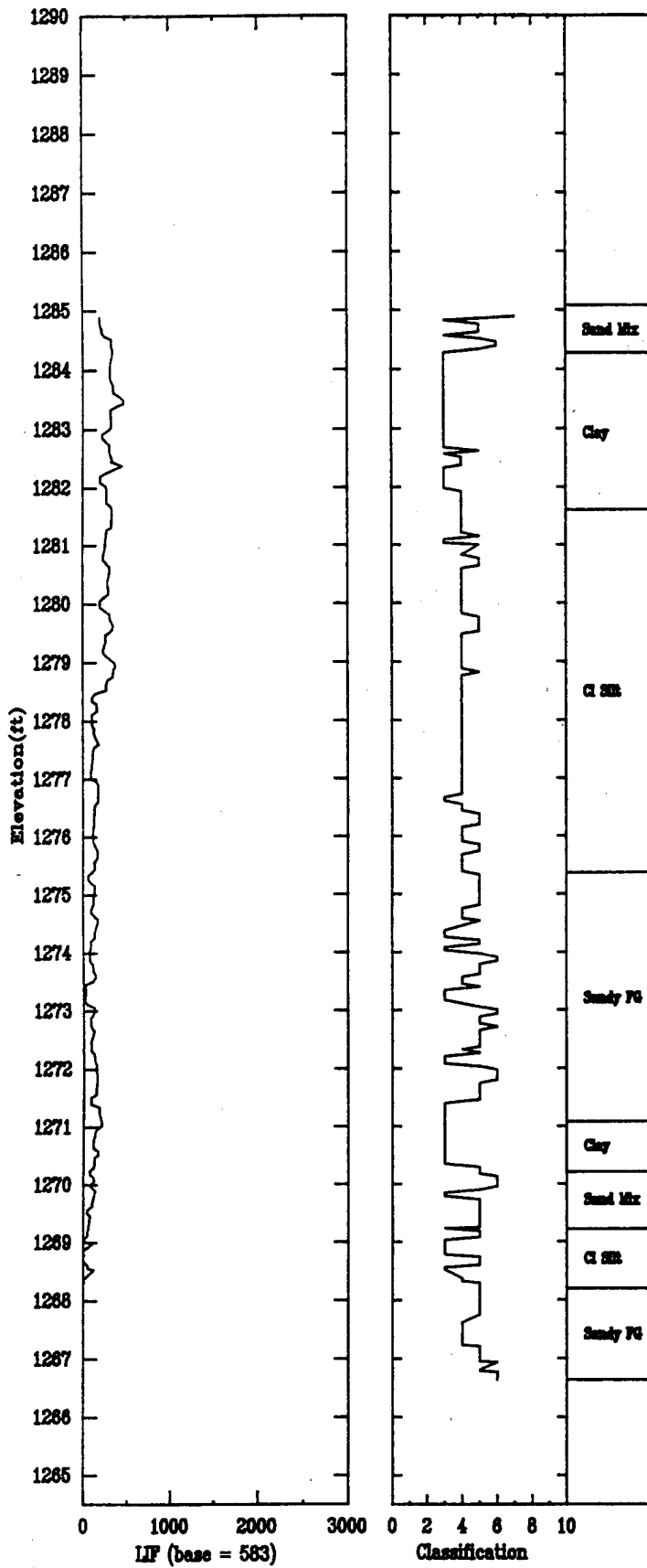
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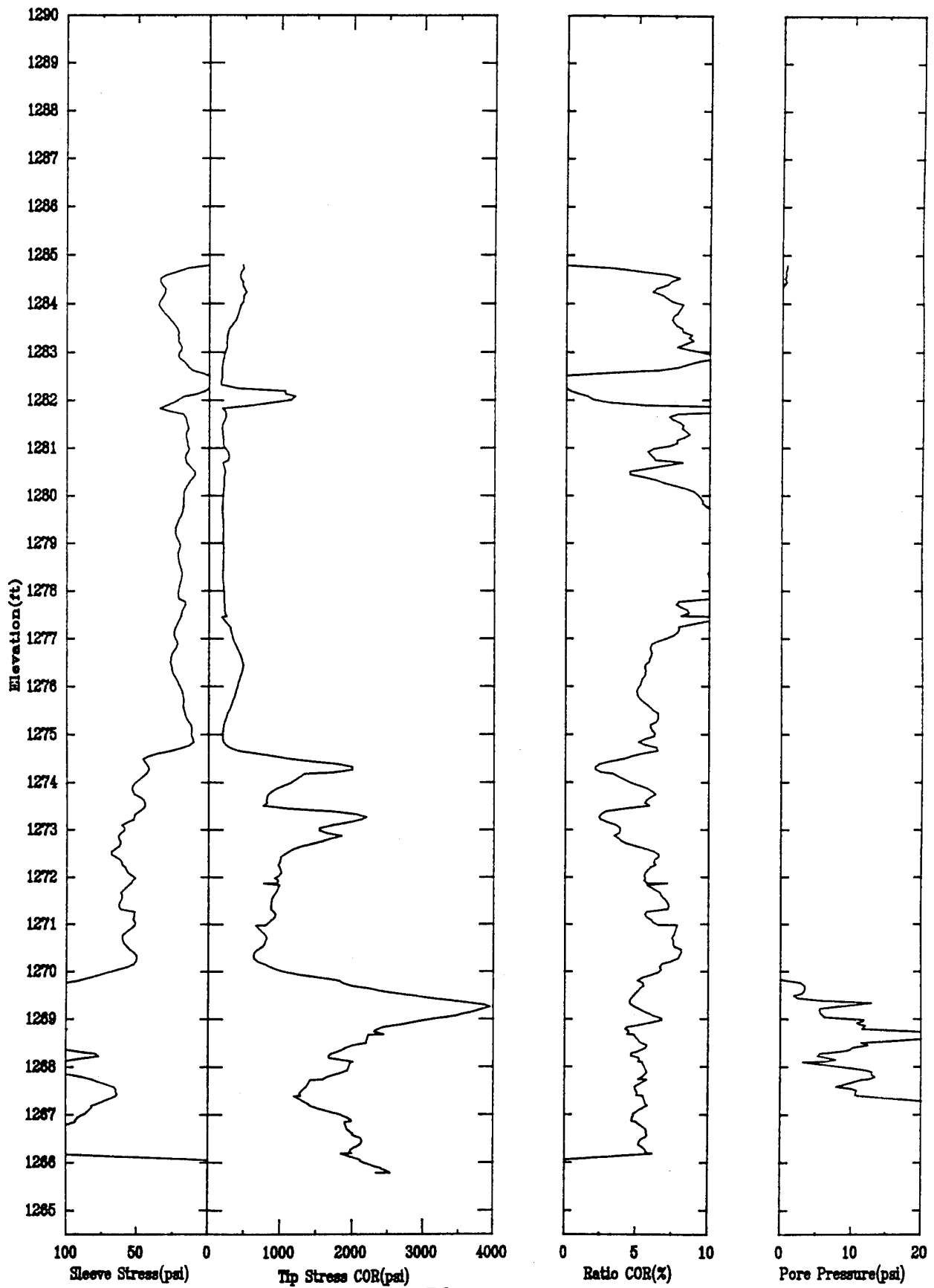
09/16/92

North 149371.

East 2185570.

Elevation 1285.1





FPA-26

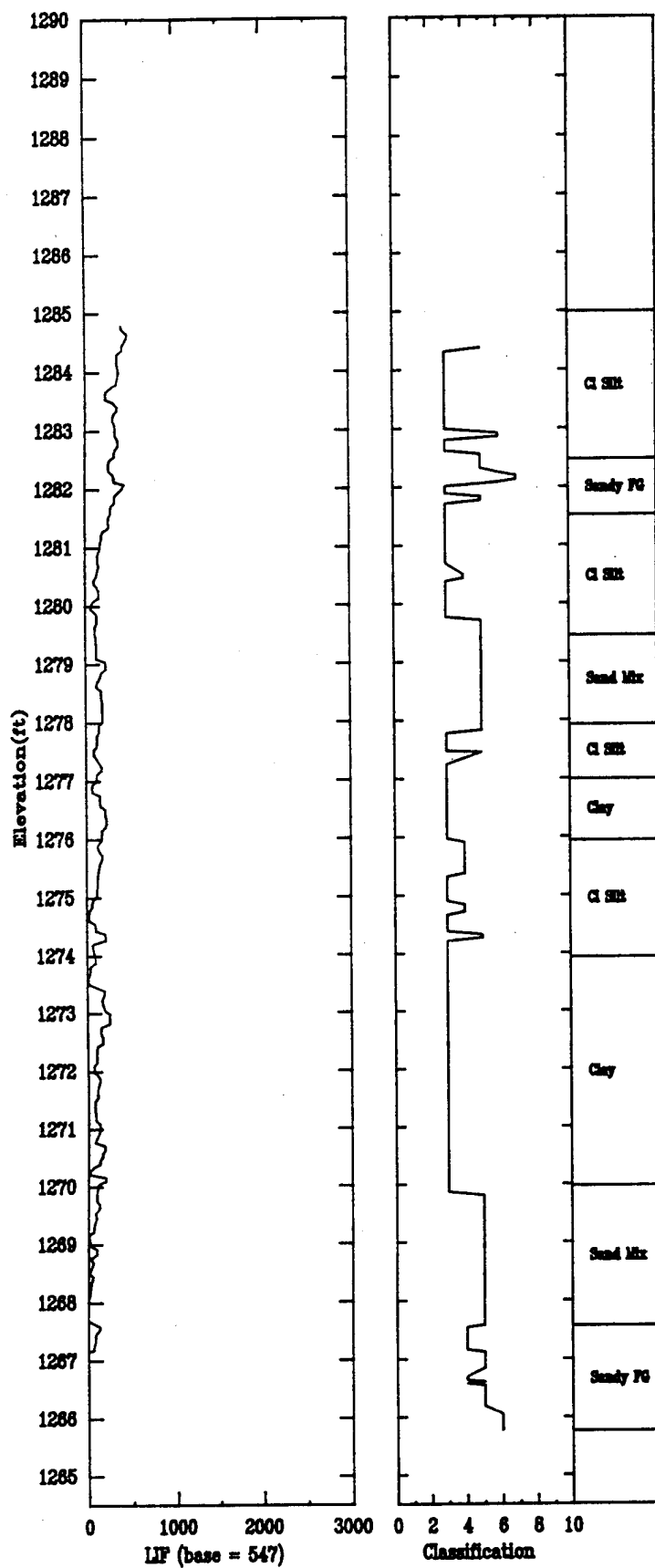
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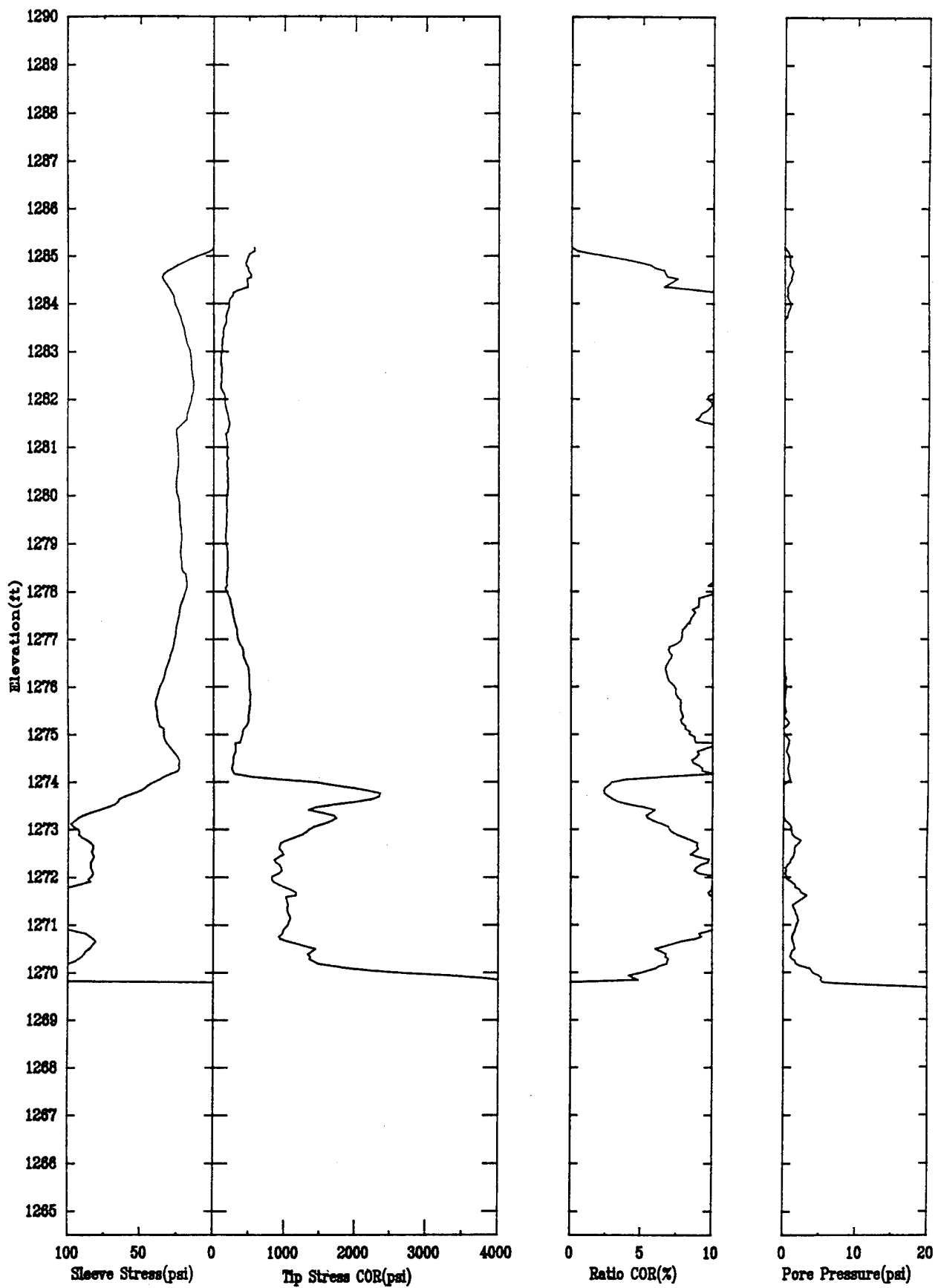
09/16/92

North 149351.

East 2185568.

Elevation 1285.0





FPA-27

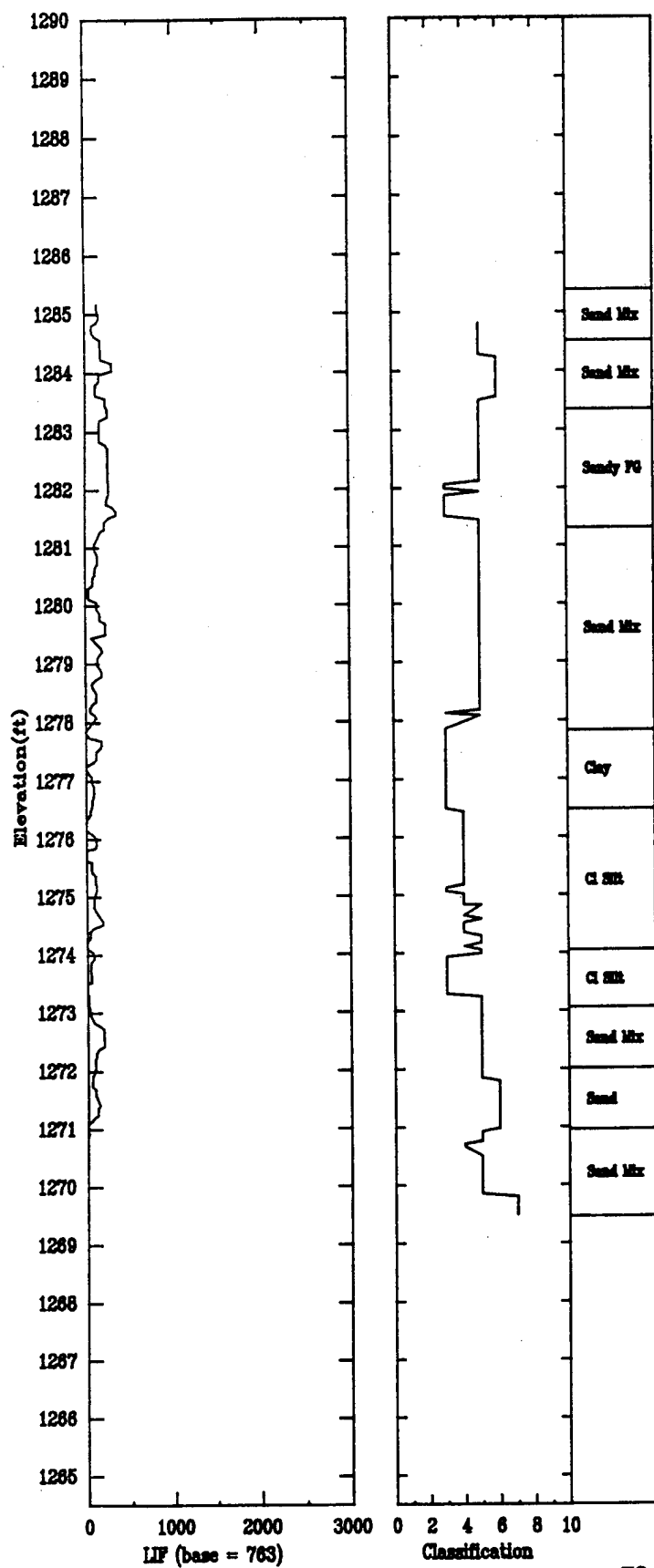
APPLIED RESEARCH ASSOCIATES, INC.

09/16/92

North 149382.

East 2185584.

Elevation 1285.4



FPA-28

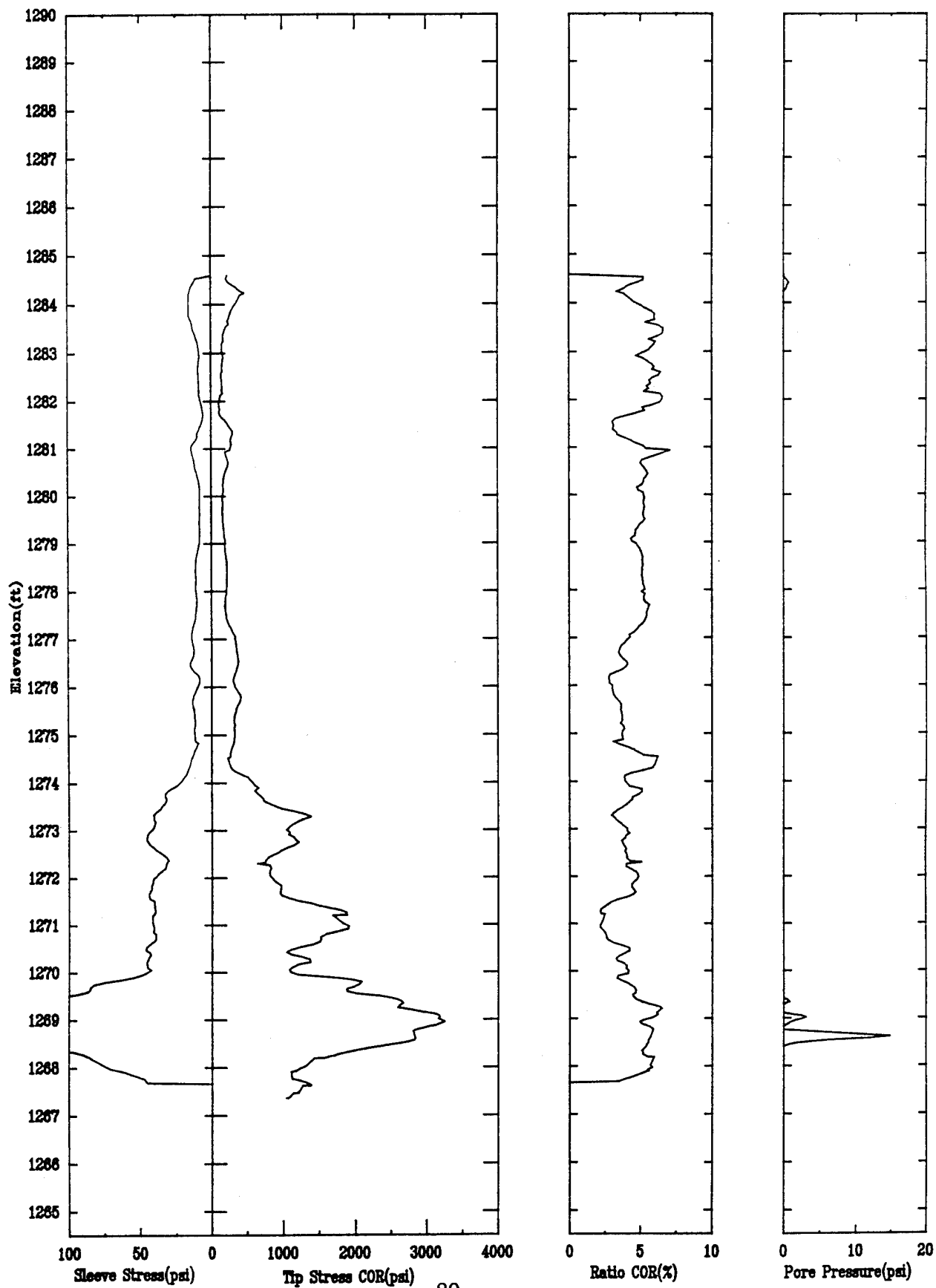
APPLIED RESEARCH ASSOCIATES, INC.

09/16/92

North 149362.

East 2185585.

Elevation 1284.8



FPA-28

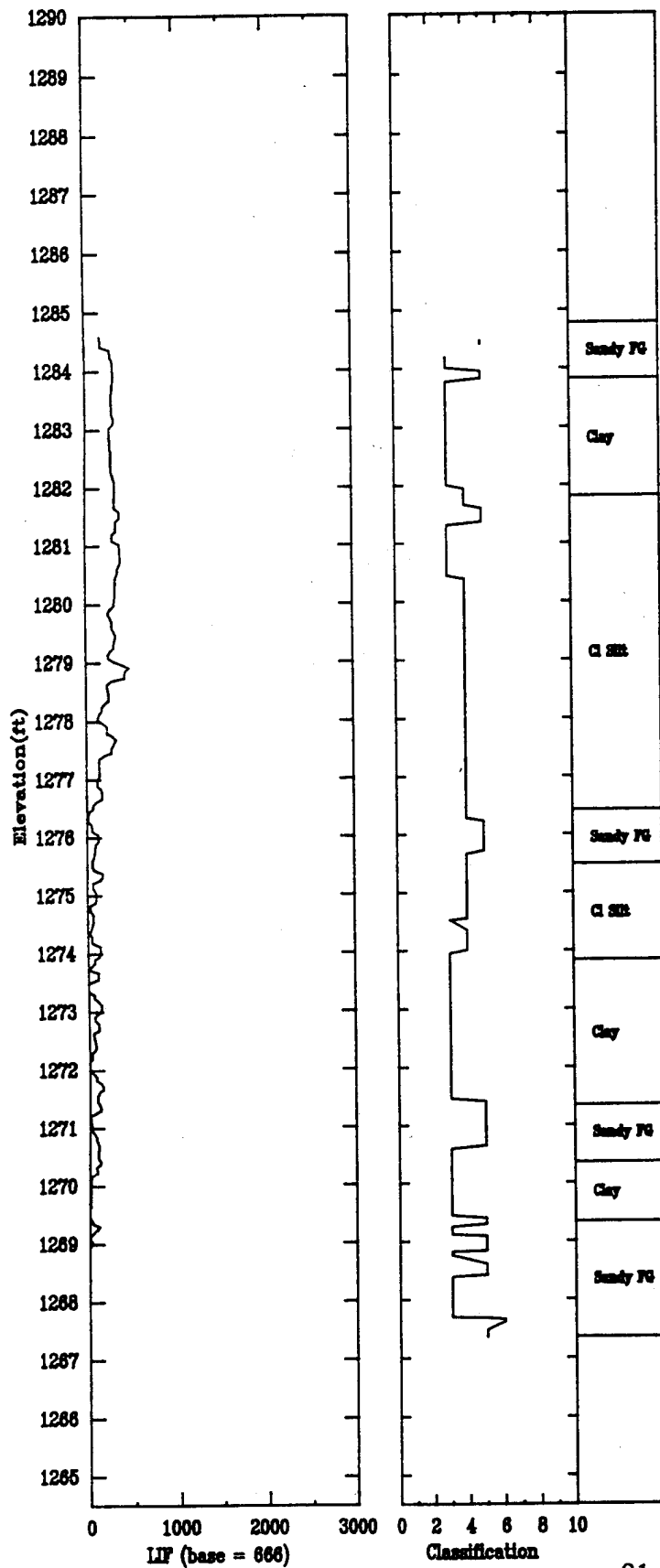
APPLIED RESEARCH ASSOCIATES, INC.

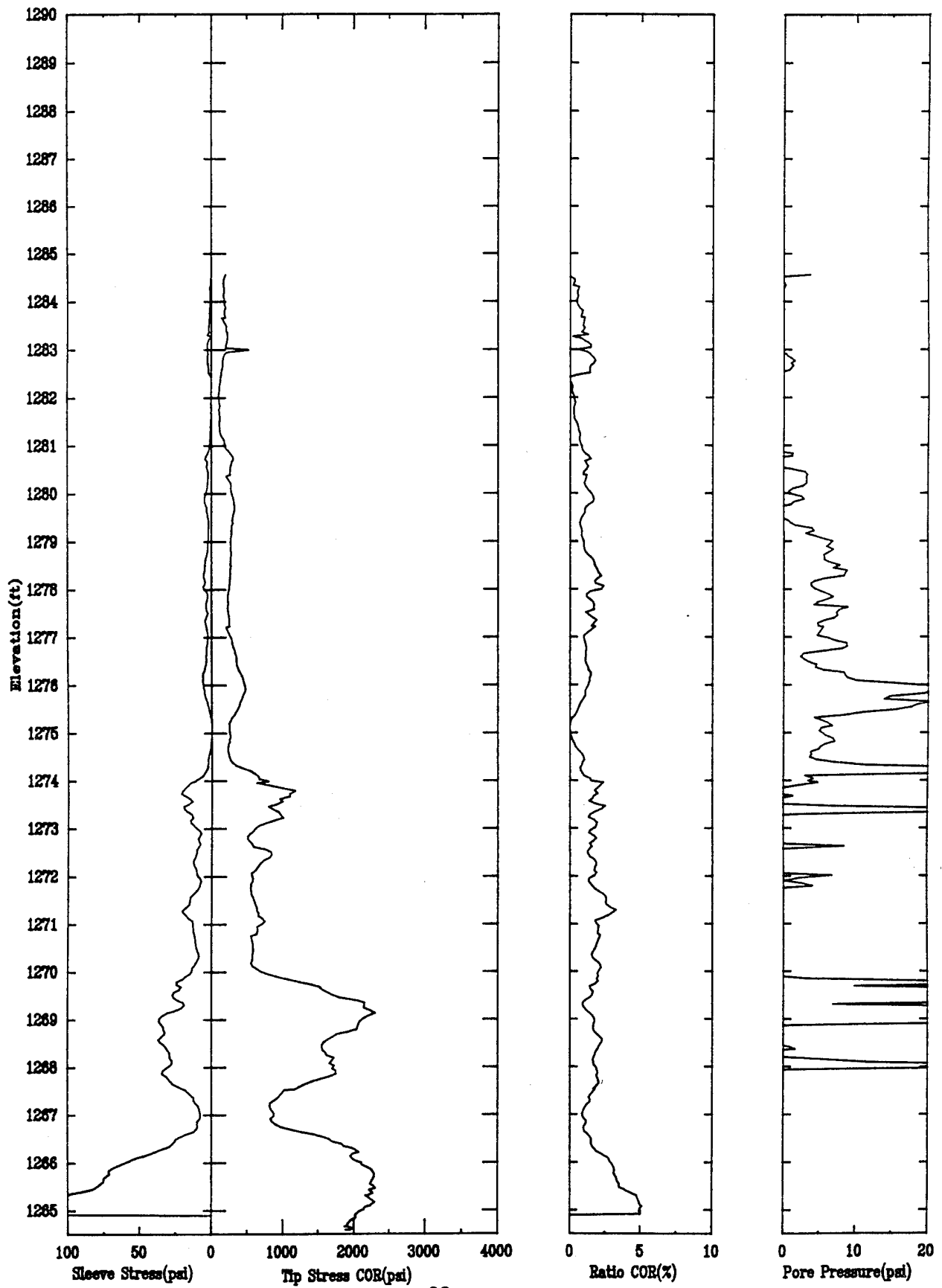
09/16/92

North 149362.

East 2185585.

Elevation 1284.8





FPA-29

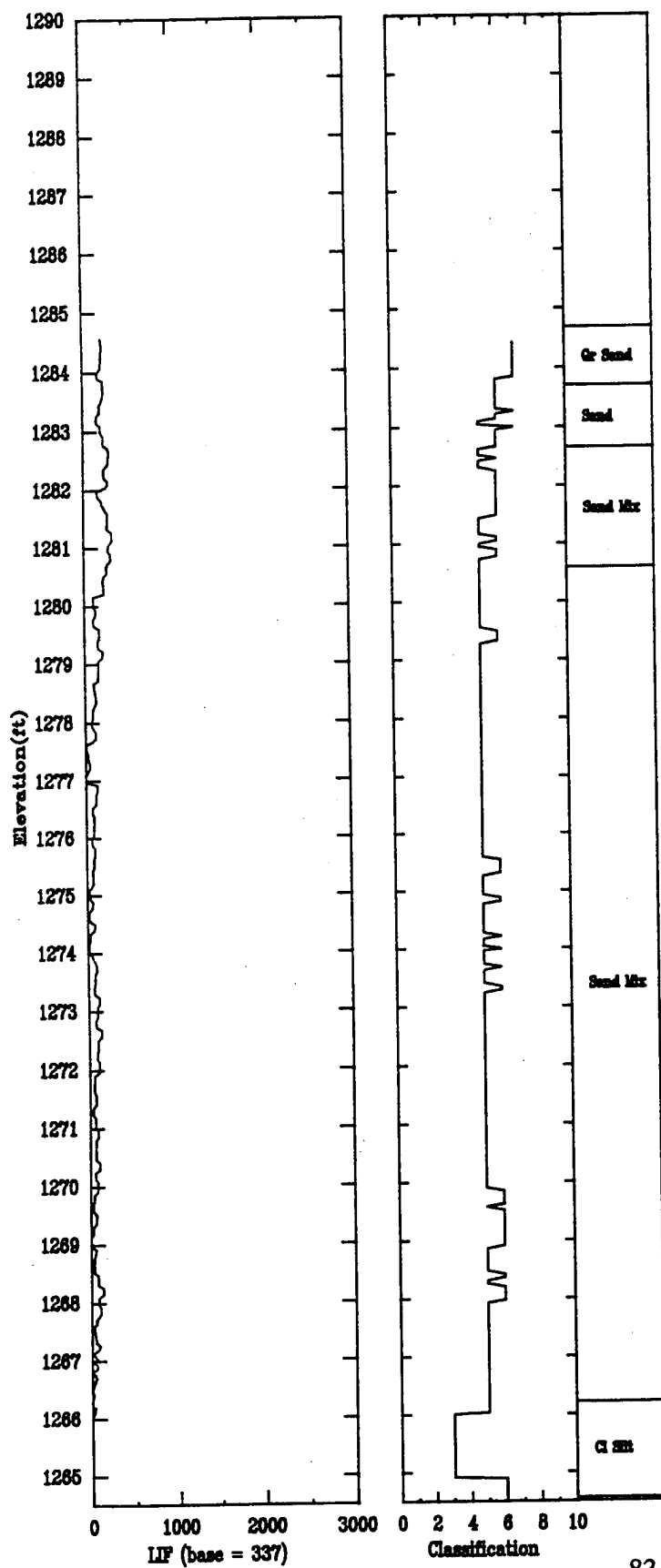
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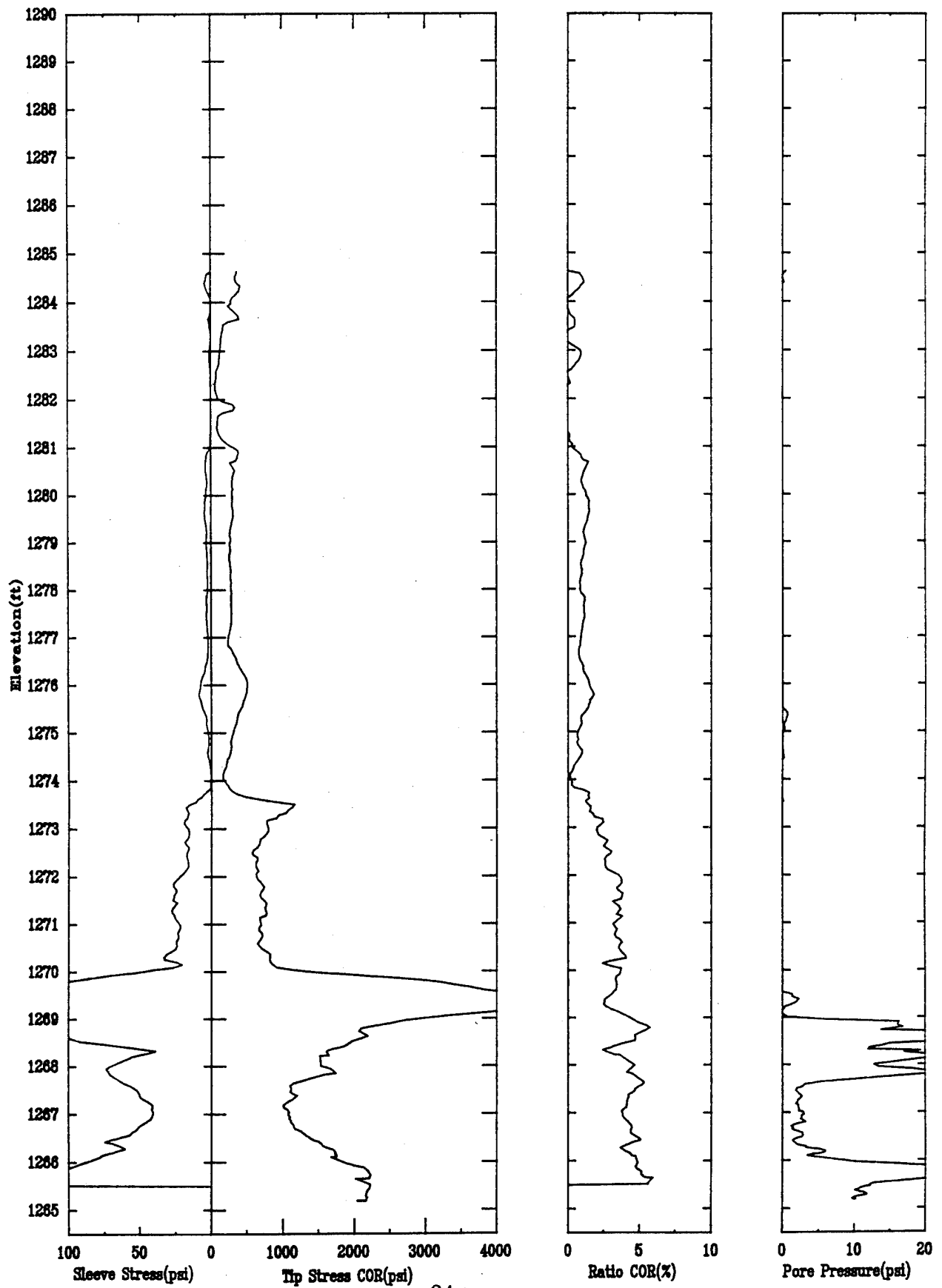
09/17/92

North 149342.

East 2185586.

Elevation 1284.7





FPA-30

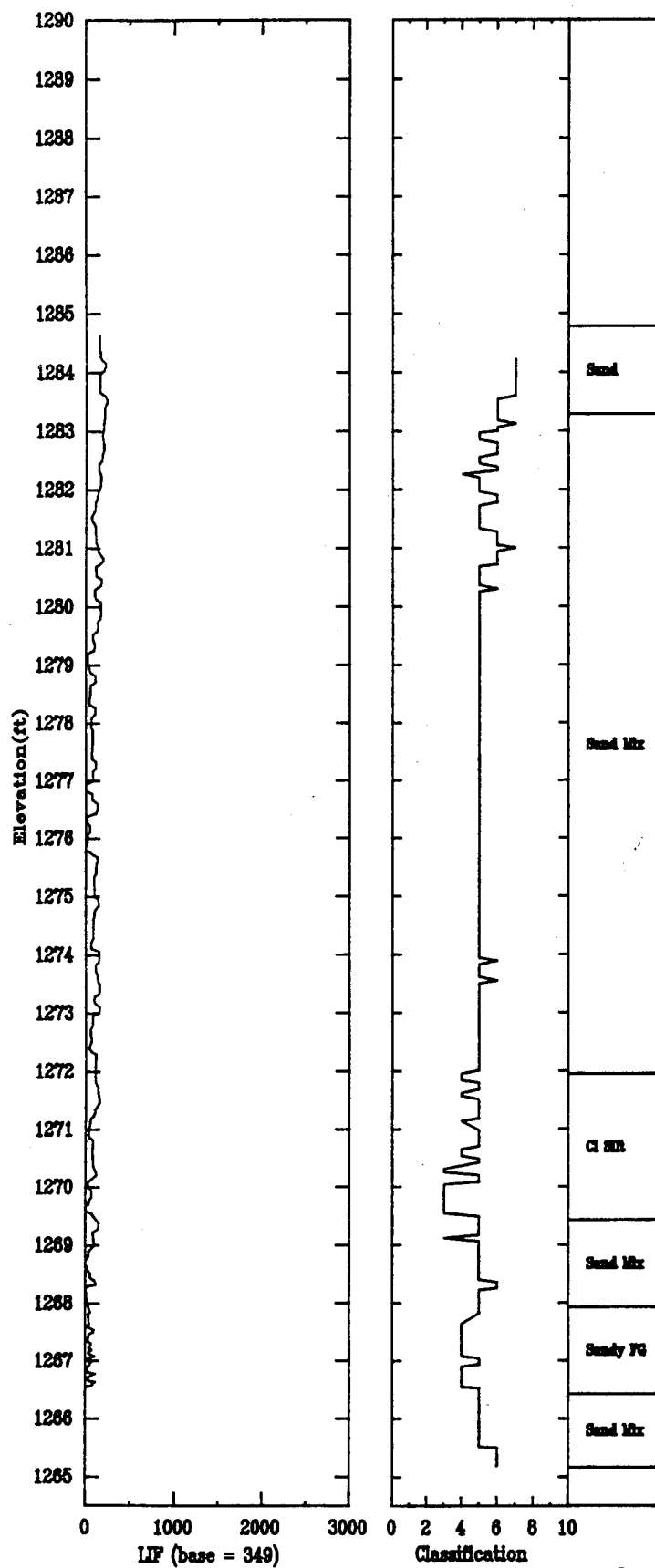
APPLIED RESEARCH ASSOCIATES, INC.

09/17/92

North 149344.

East 2185602.

Elevation 1284.8



FPA-31

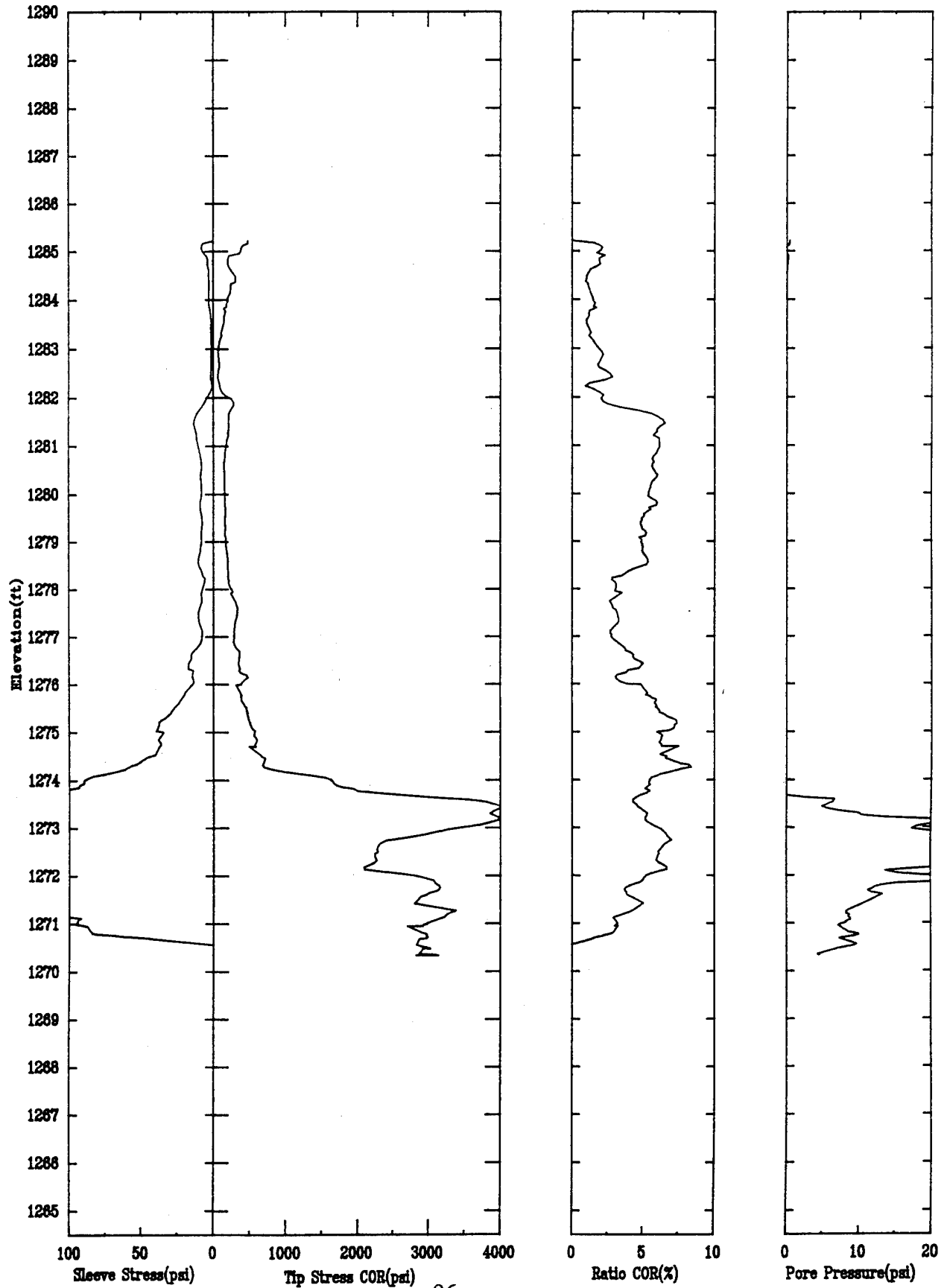
APPLIED RESEARCH ASSOCIATES, INC.

09/17/92

North 149390.

East 2185541.

Elevation 1285.4



FPA-31

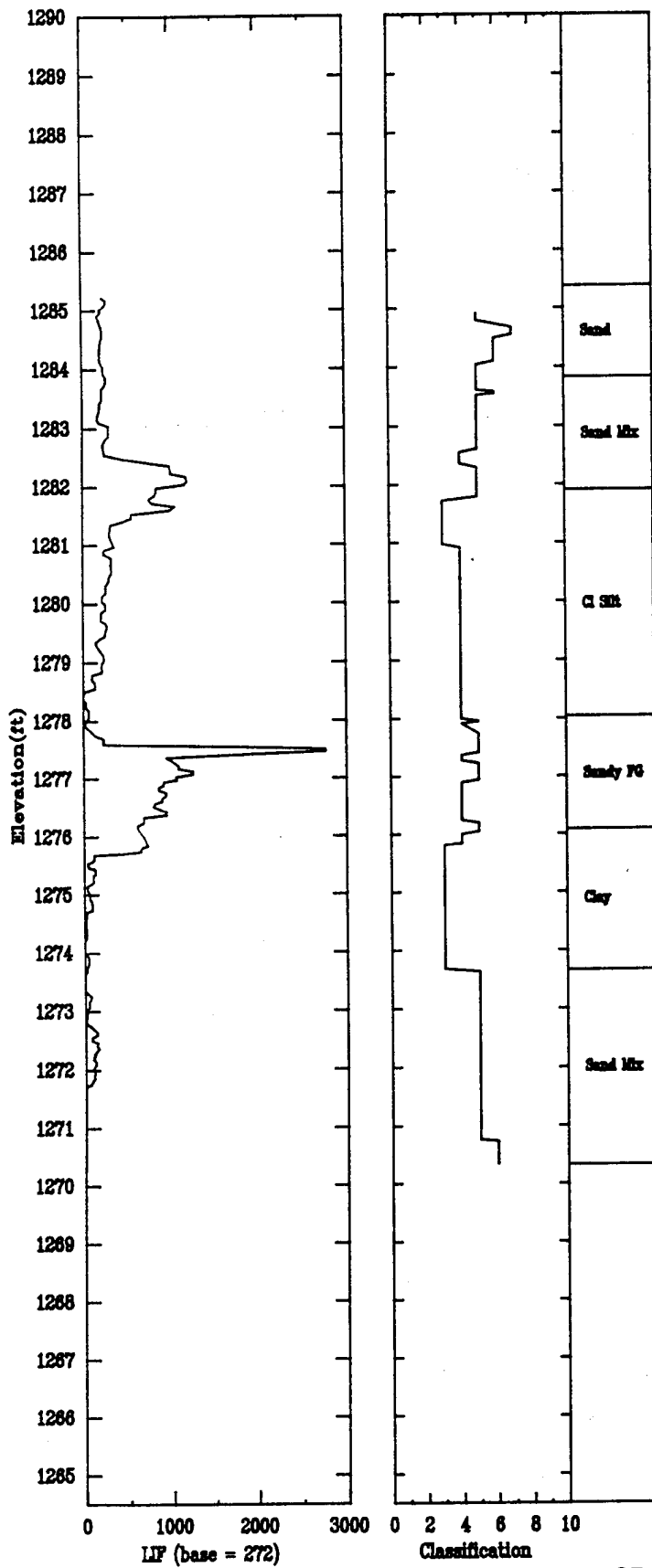
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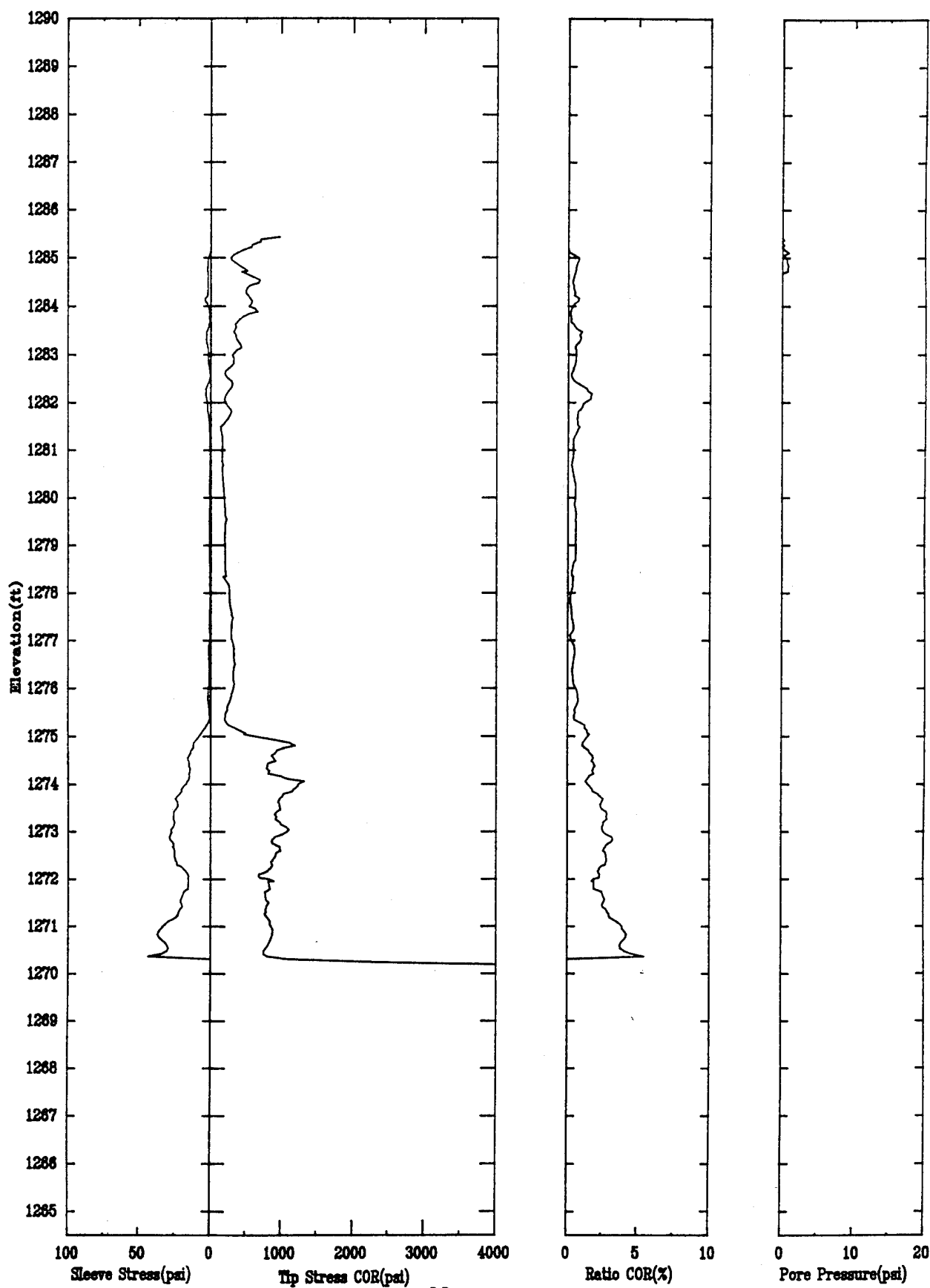
09/17/92

North 149390.

East 2185541.

Elevation 1285.4





FPA-32

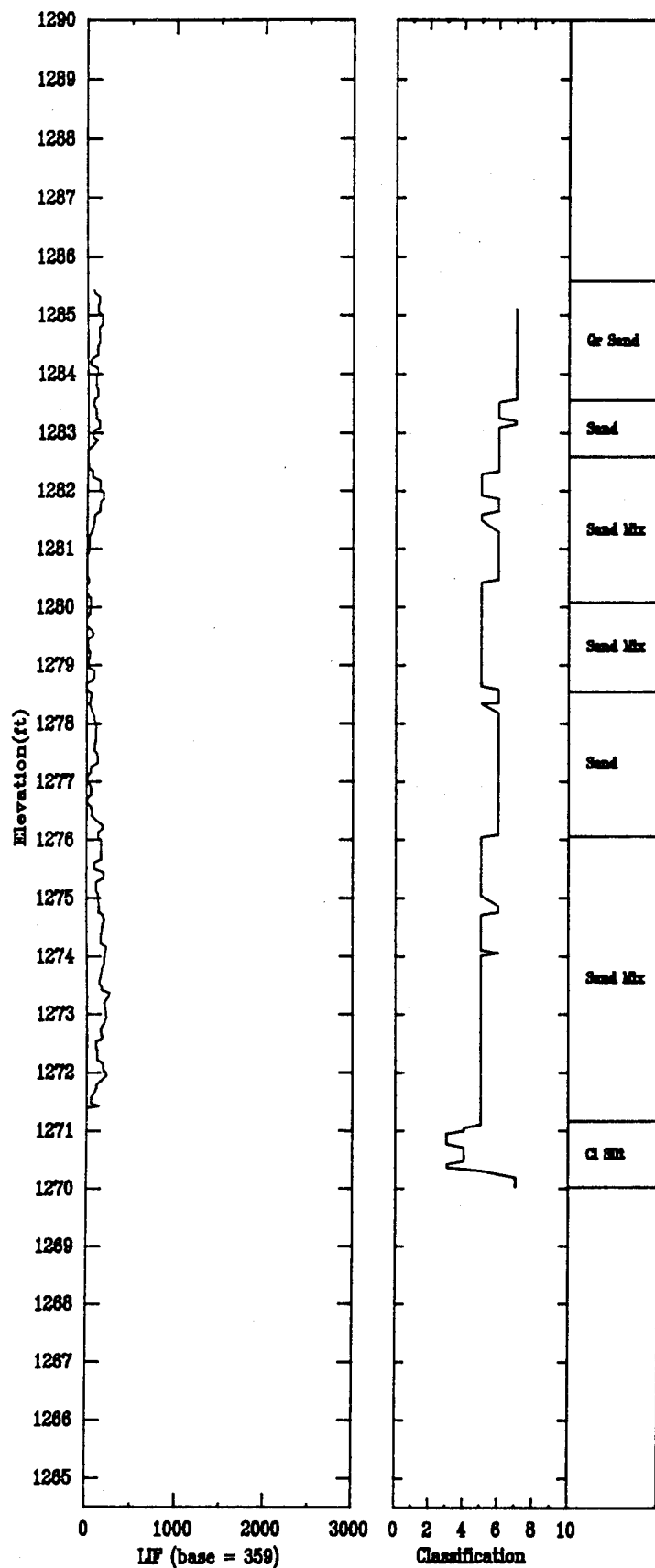
APPLIED RESEARCH ASSOCIATES, INC.

09/17/92

North 149398.

East 2185593.

Elevation 1285.6



FPA-33

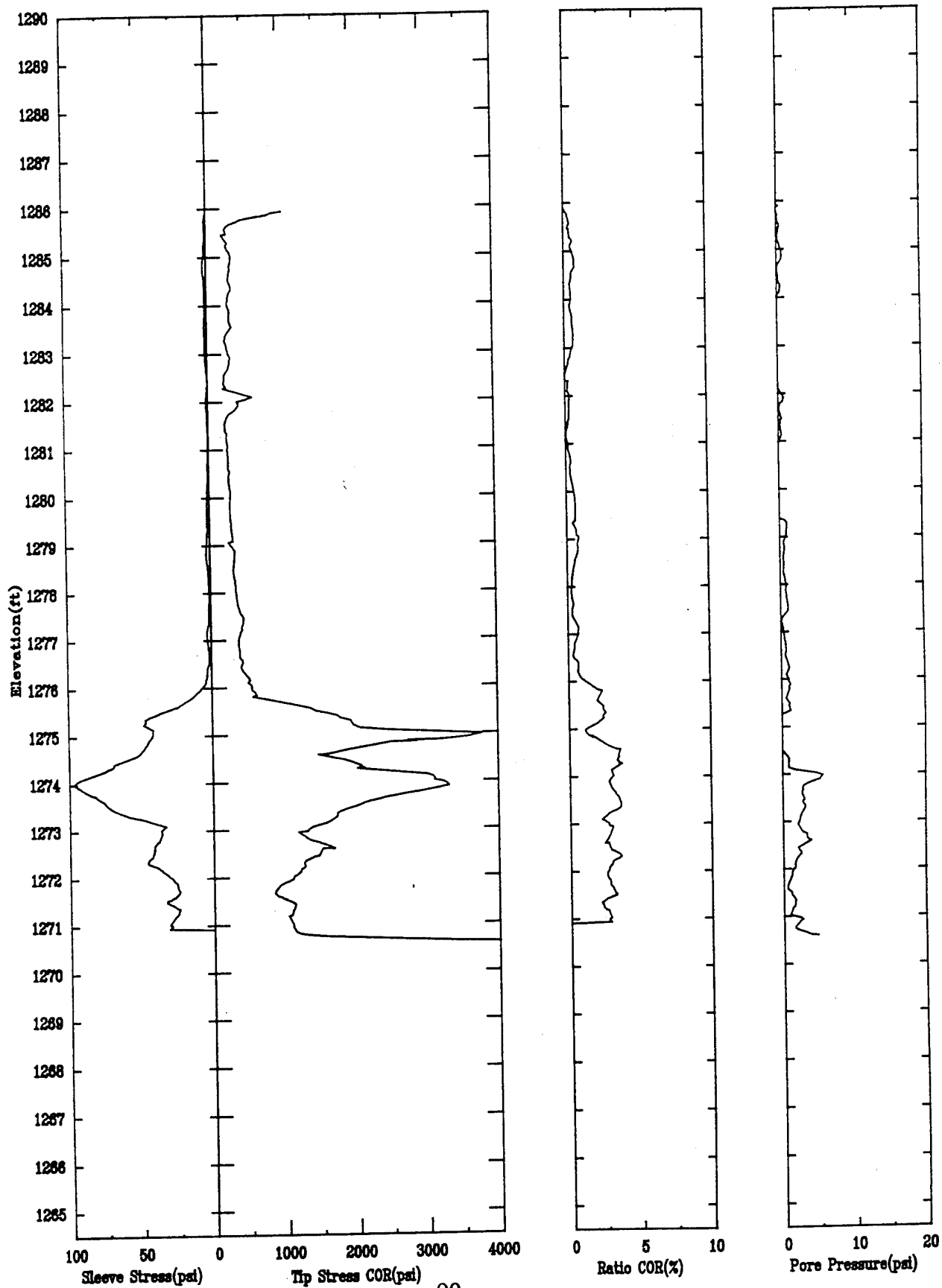
APPLIED RESEARCH ASSOCIATES, INC.

09/17/92

North 149443.

East 2185594.

Elevation 1286.1



FPA-33

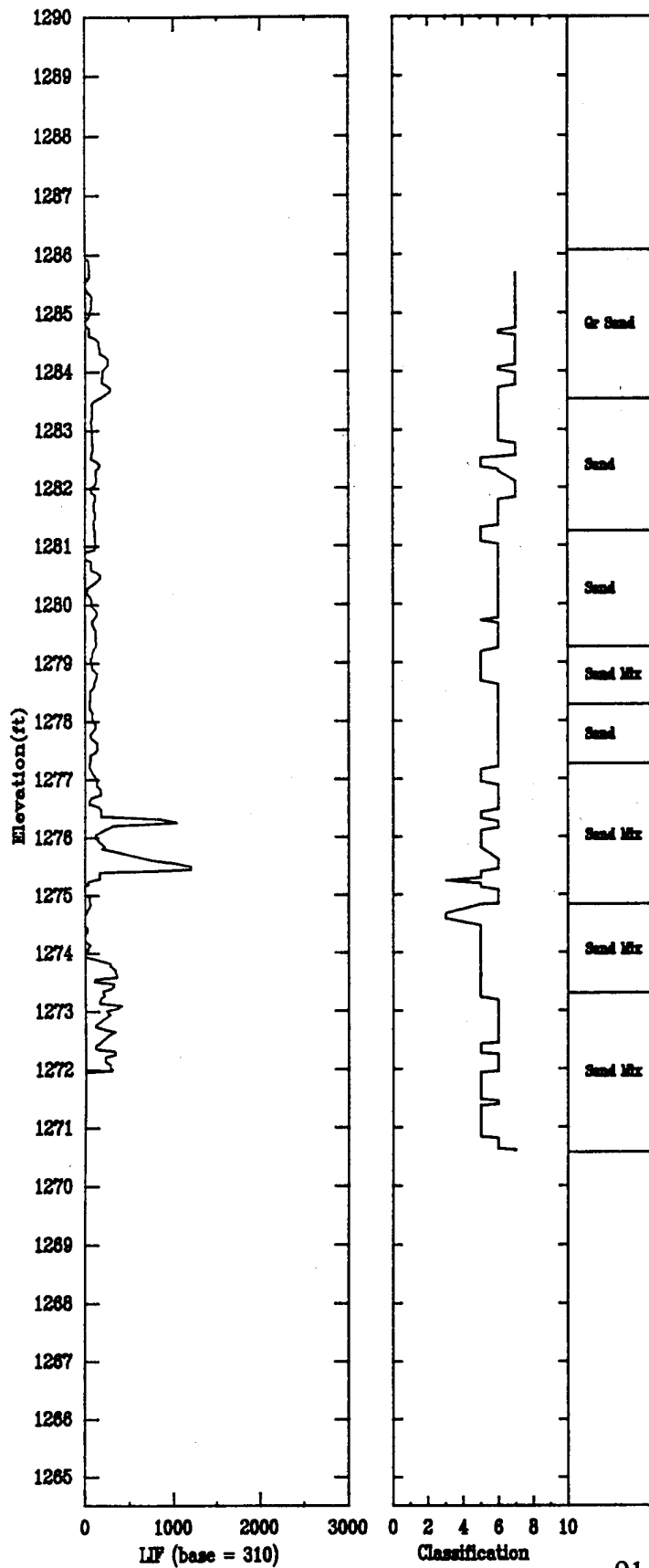
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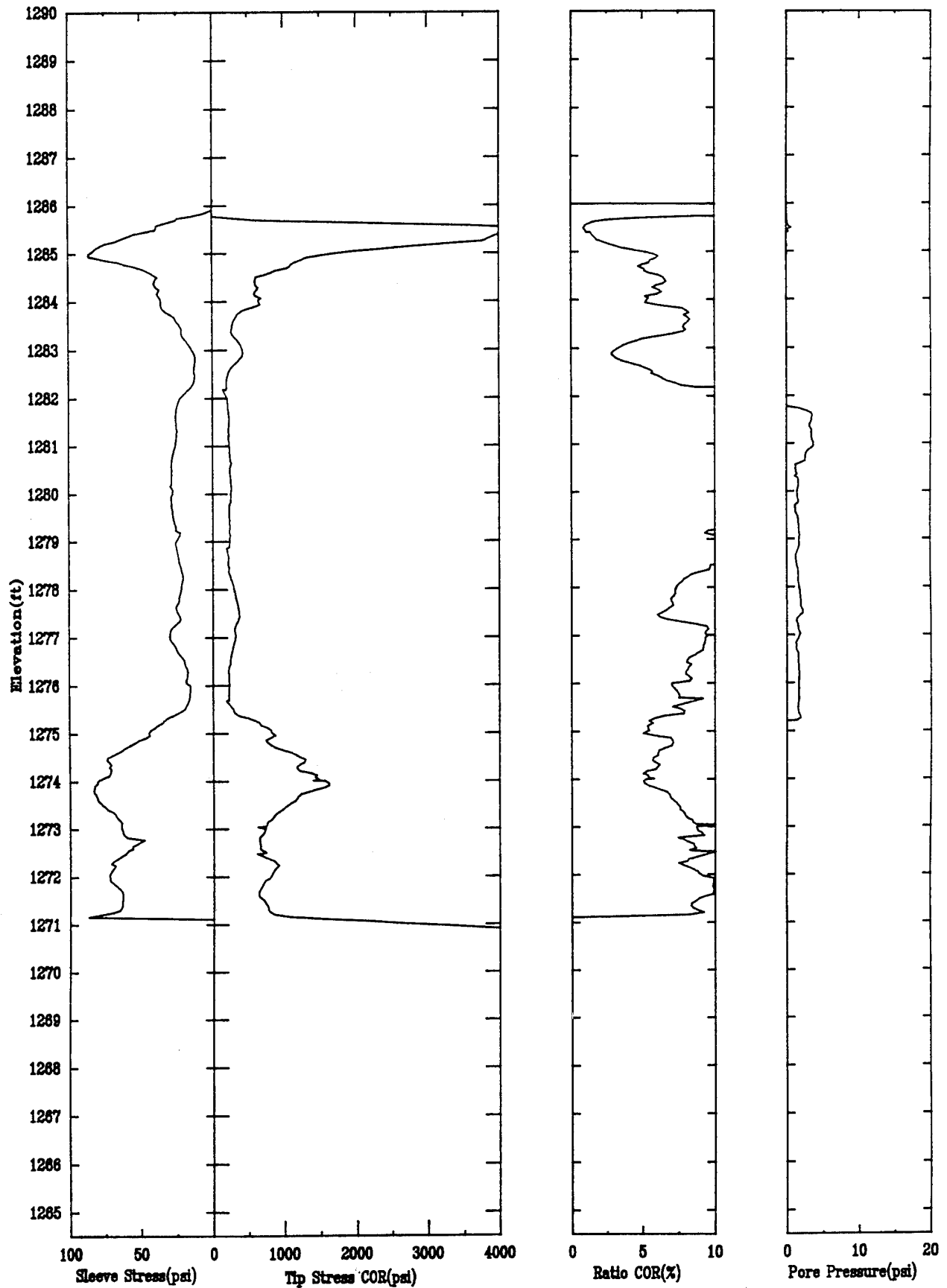
09/17/92

North 149443.

East 2185594.

Elevation 1286.1





FPA-34

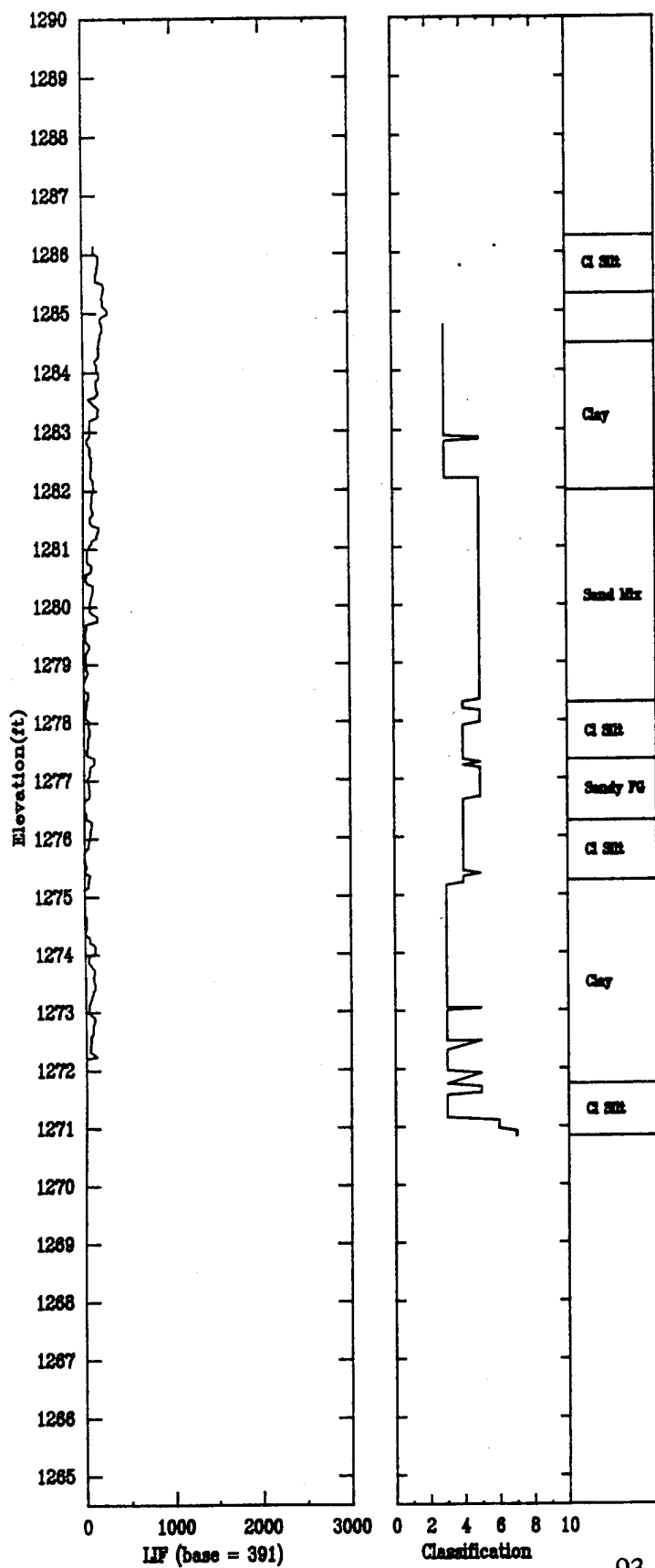
APPLIED RESEARCH ASSOCIATES, INC.

09/17/92

North 149420.

East 2185615.

Elevation 1286.3



FPA-35

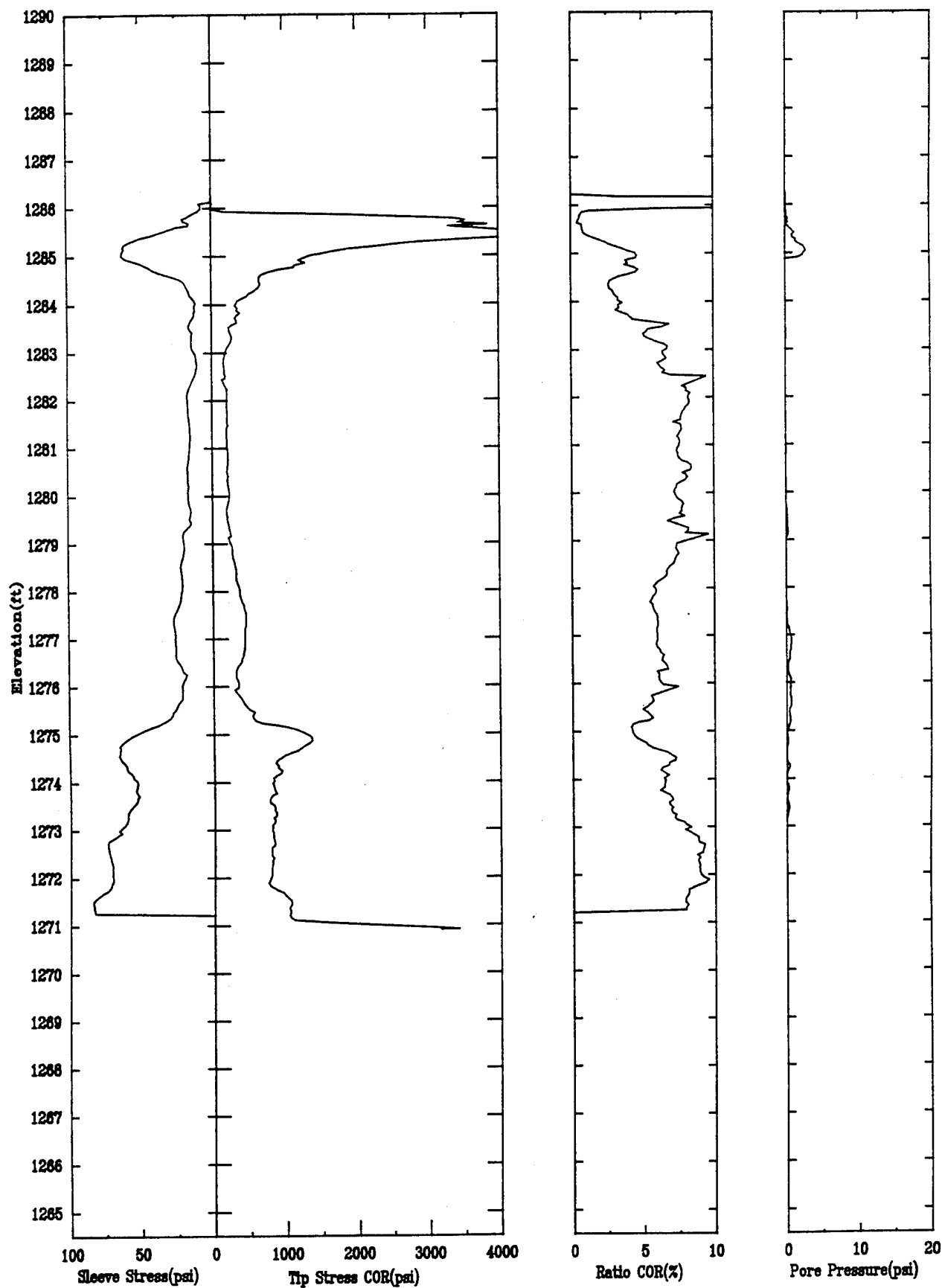
APPLIED RESEARCH ASSOCIATES, INC.

09/17/92

North 149444.

East 2185630.

Elevation 1286.4



FPA-35

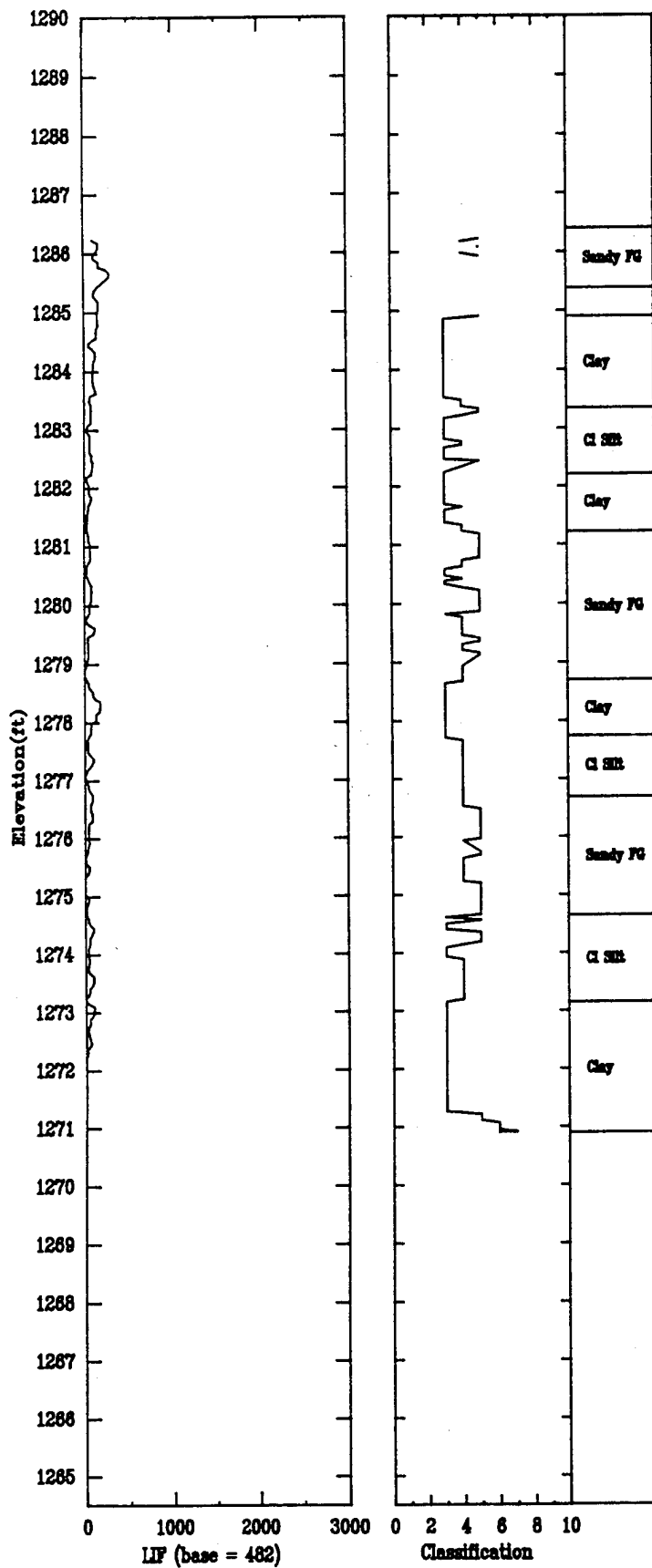
APPLIED RESEARCH ASSOCIATES, INC.

09/17/92

North 149444.

East 2185630.

Elevation 1286.4



FPA-36

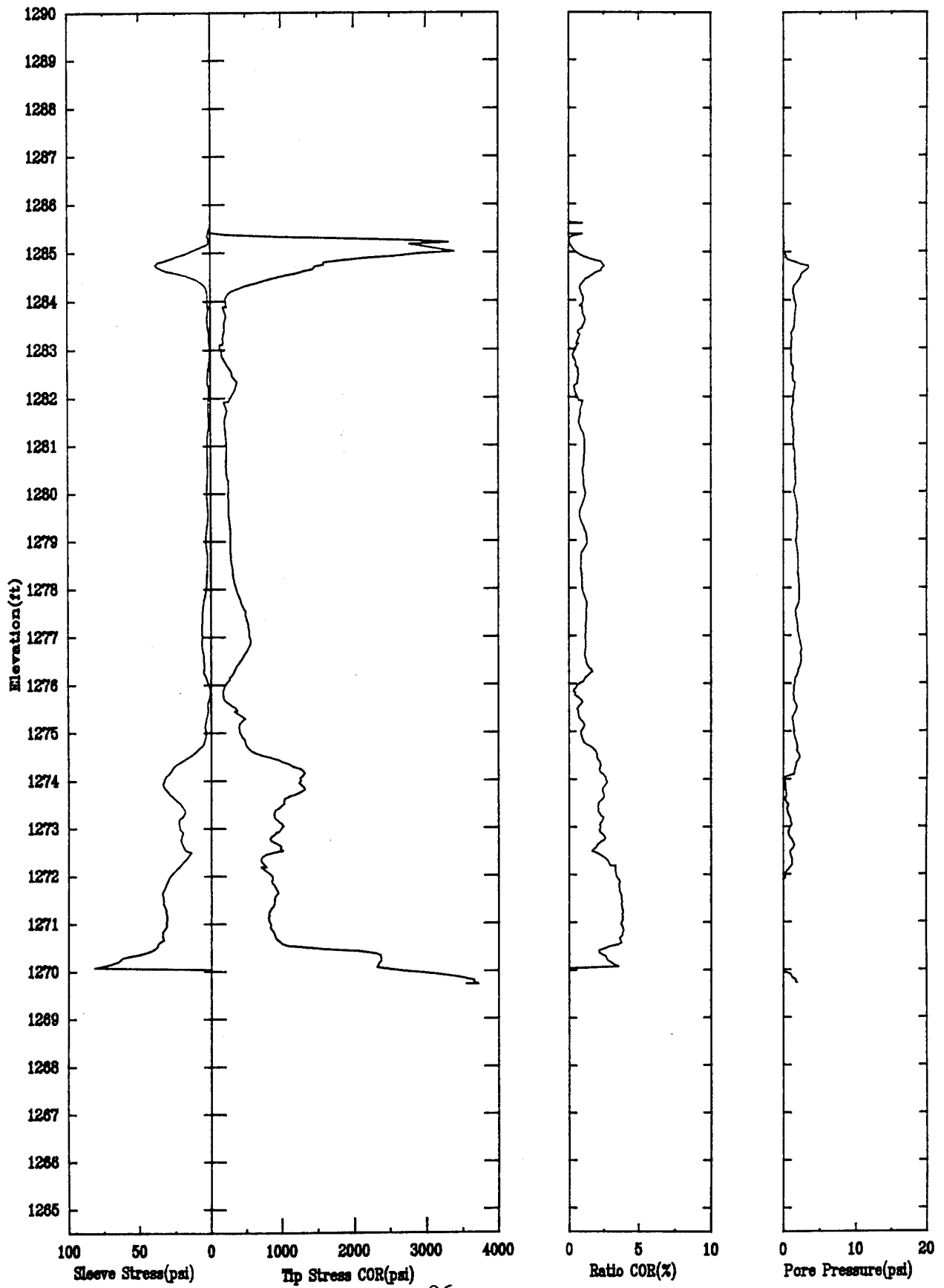
APPLIED RESEARCH ASSOCIATES, INC.

09/17/92

North 149398.

East 2185626.

Elevation 1285.9



FPA-36

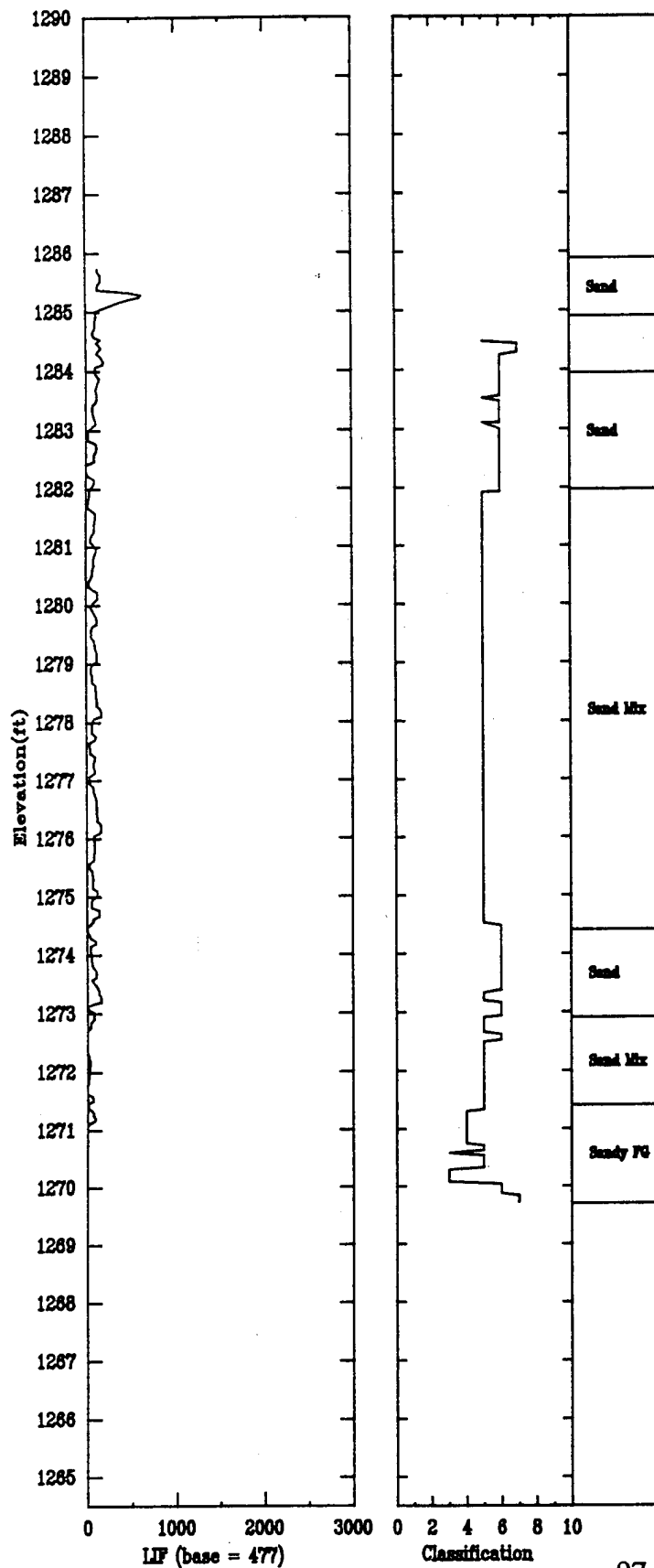
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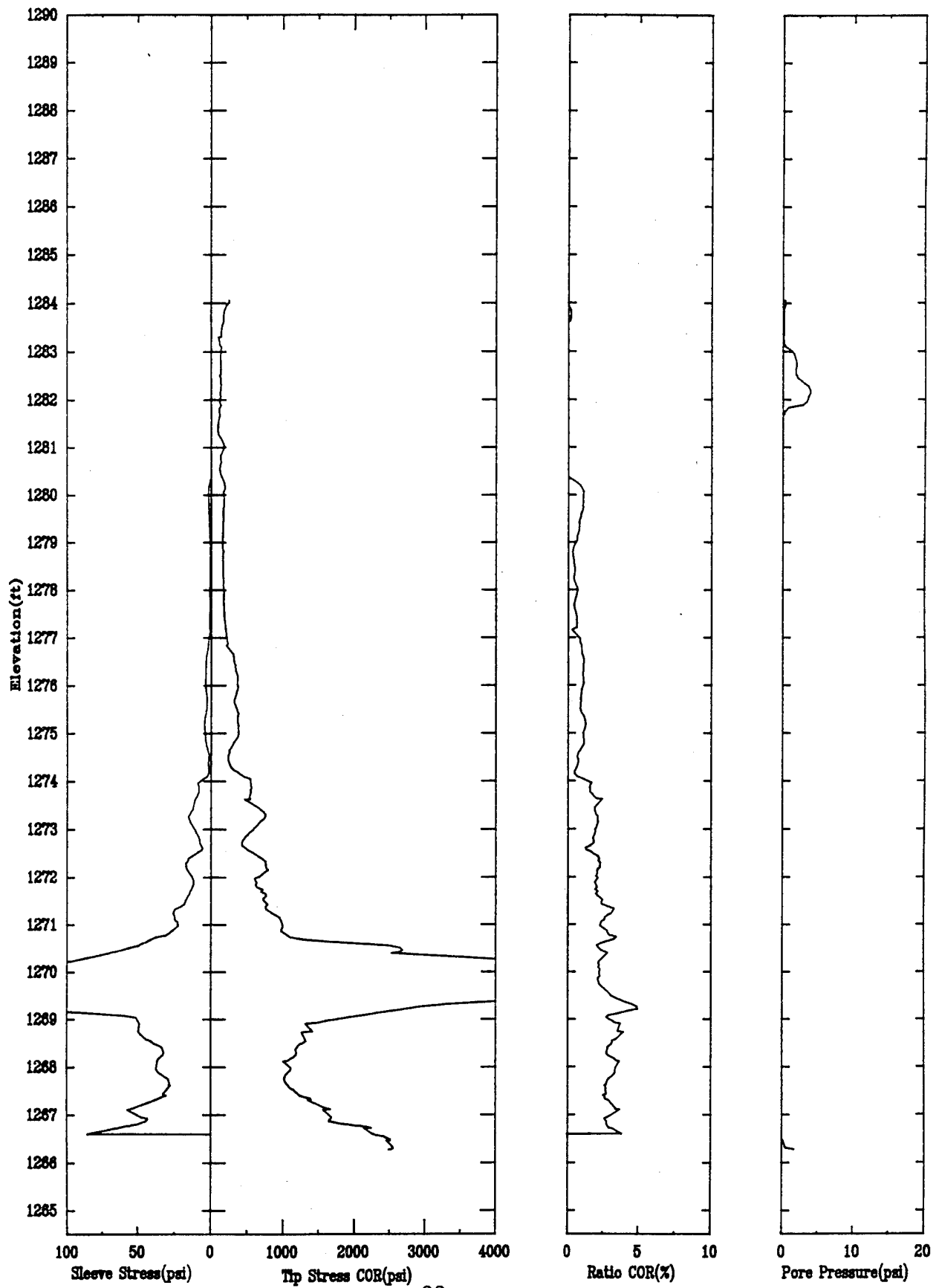
09/17/92

North 149398.

East 2185626.

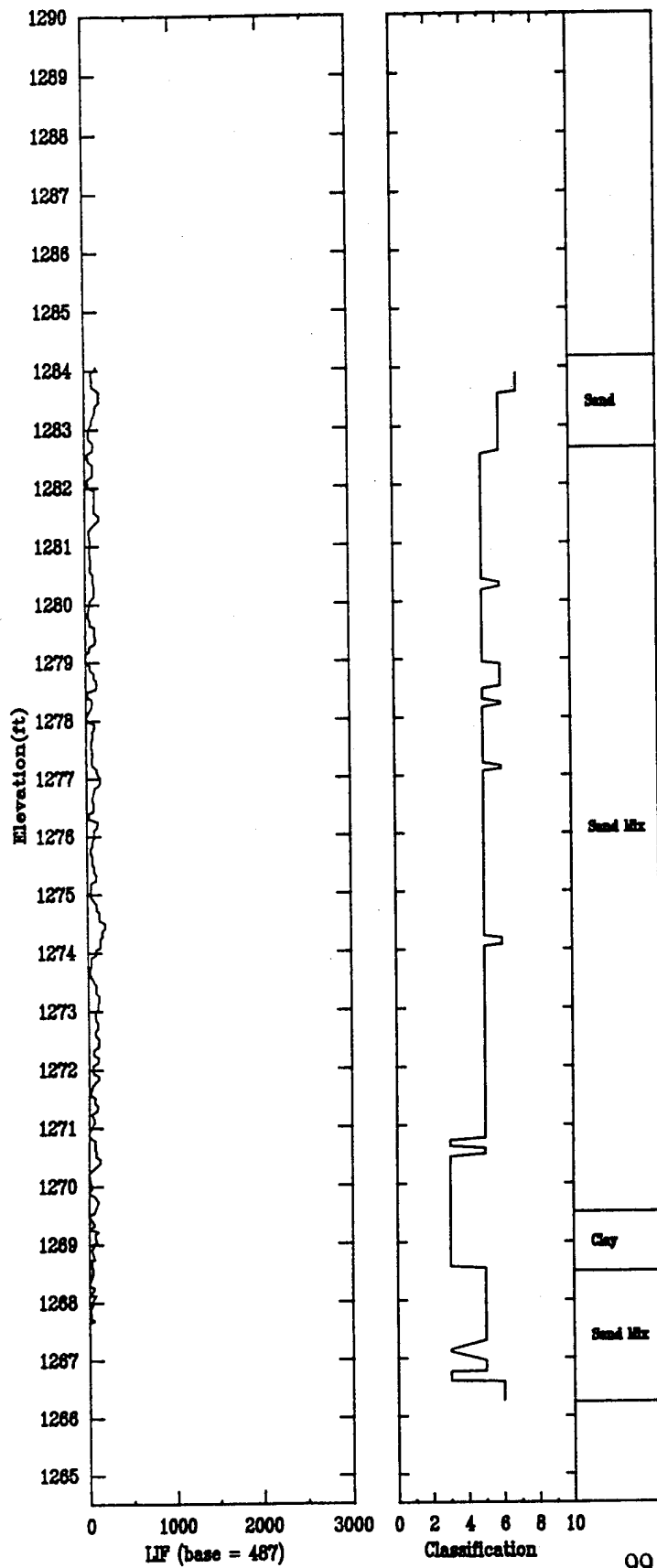
Elevation 1285.9





09/17/92

Elevation 1284.2



FPA-38

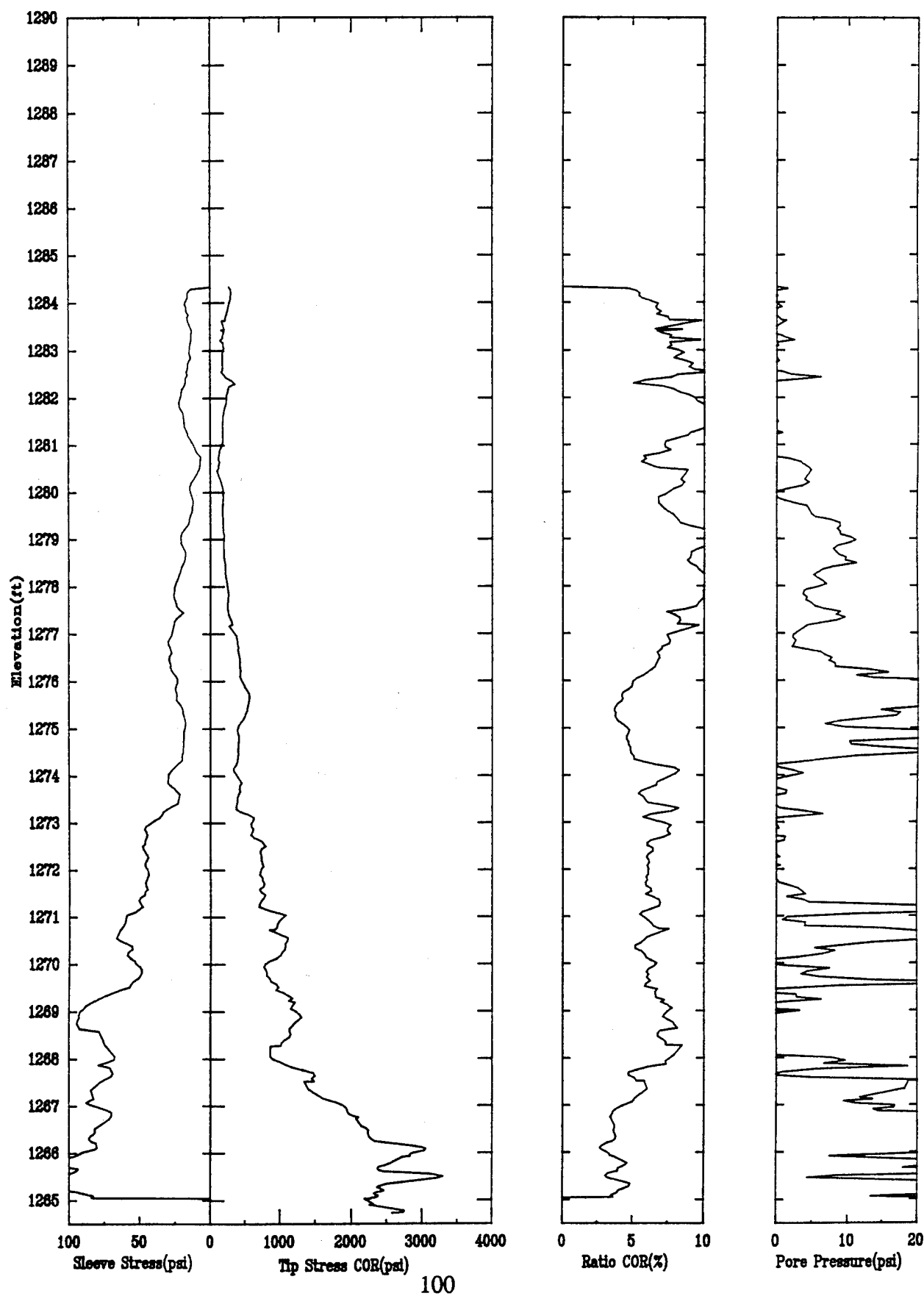
APPLIED RESEARCH ASSOCIATES, INC.

09/17/92

North 149319.

East 2185492.

Elevation 1284.5



FPA-38

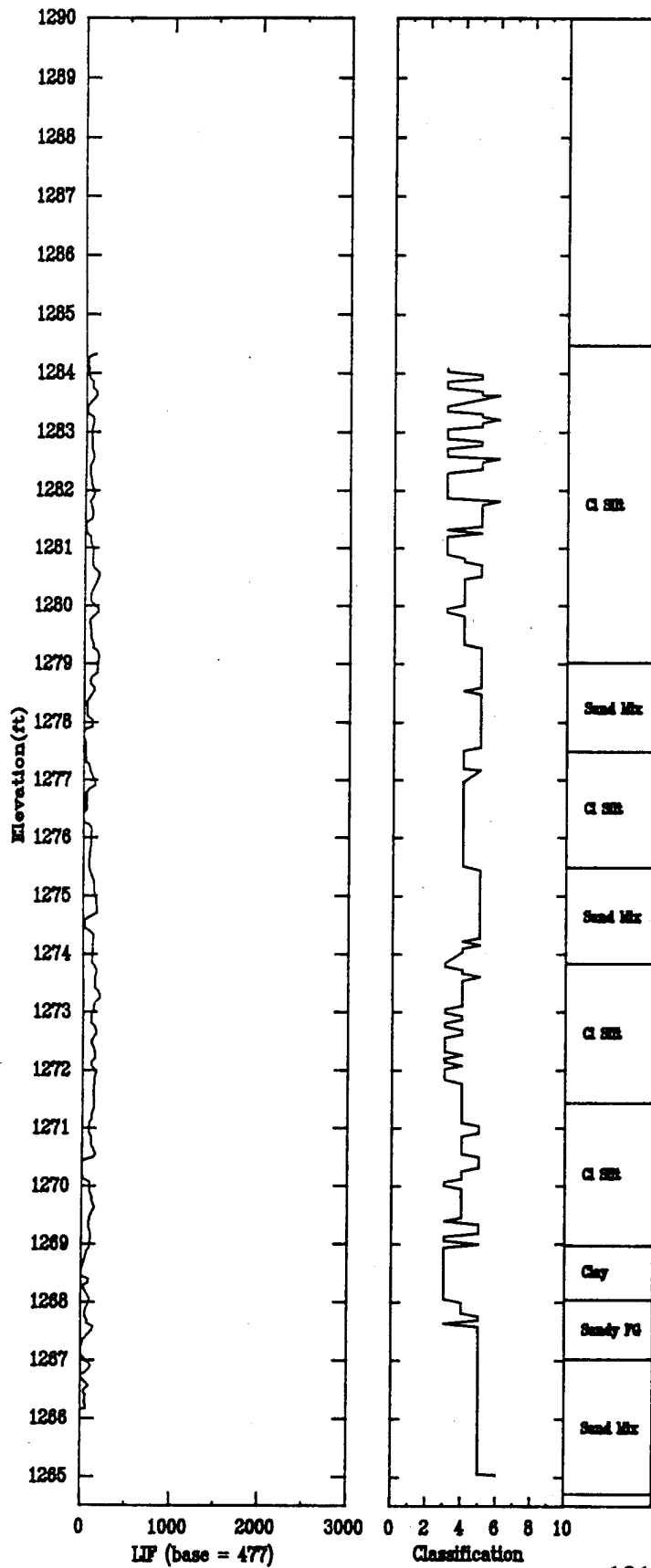
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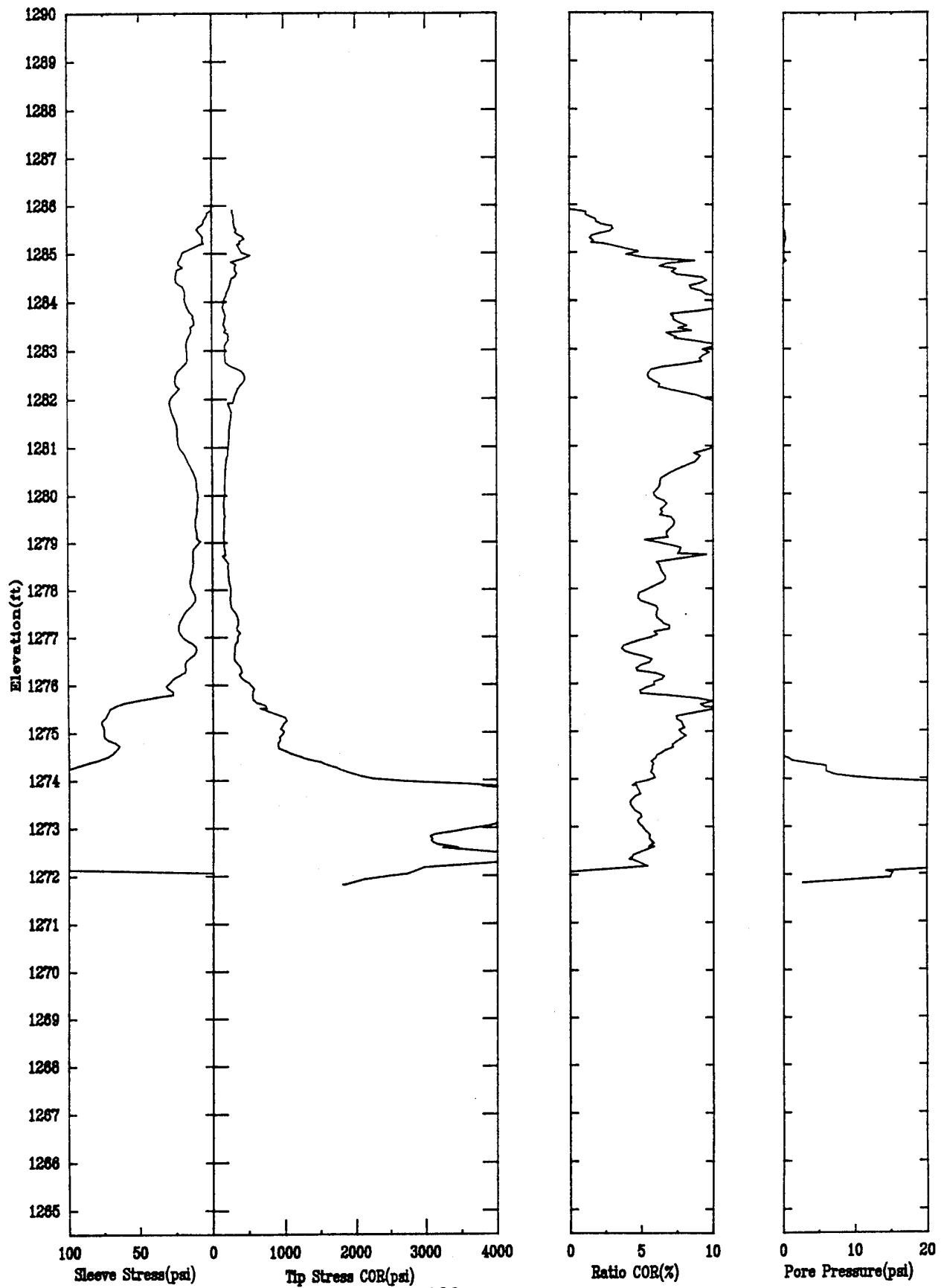
09/17/92

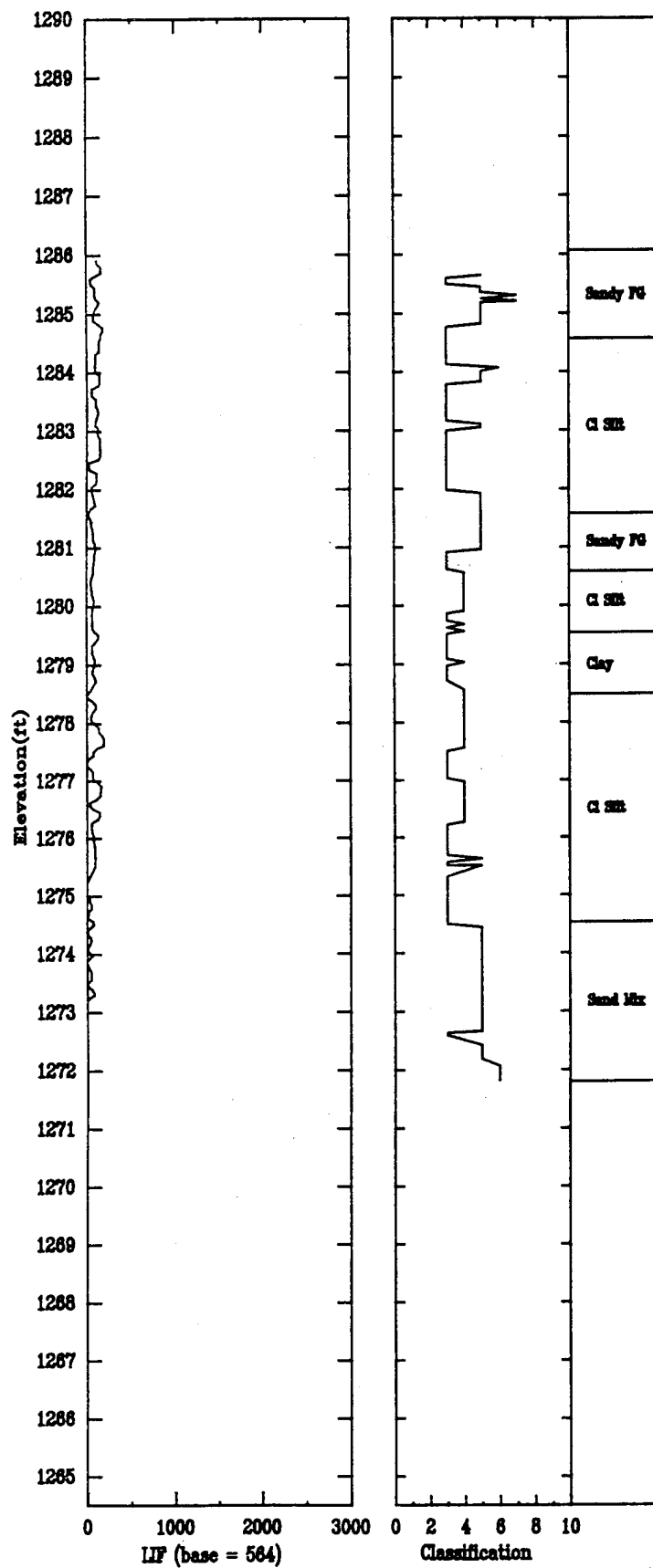
North 149319.

East 2185492.

Elevation 1284.5







FPA-40

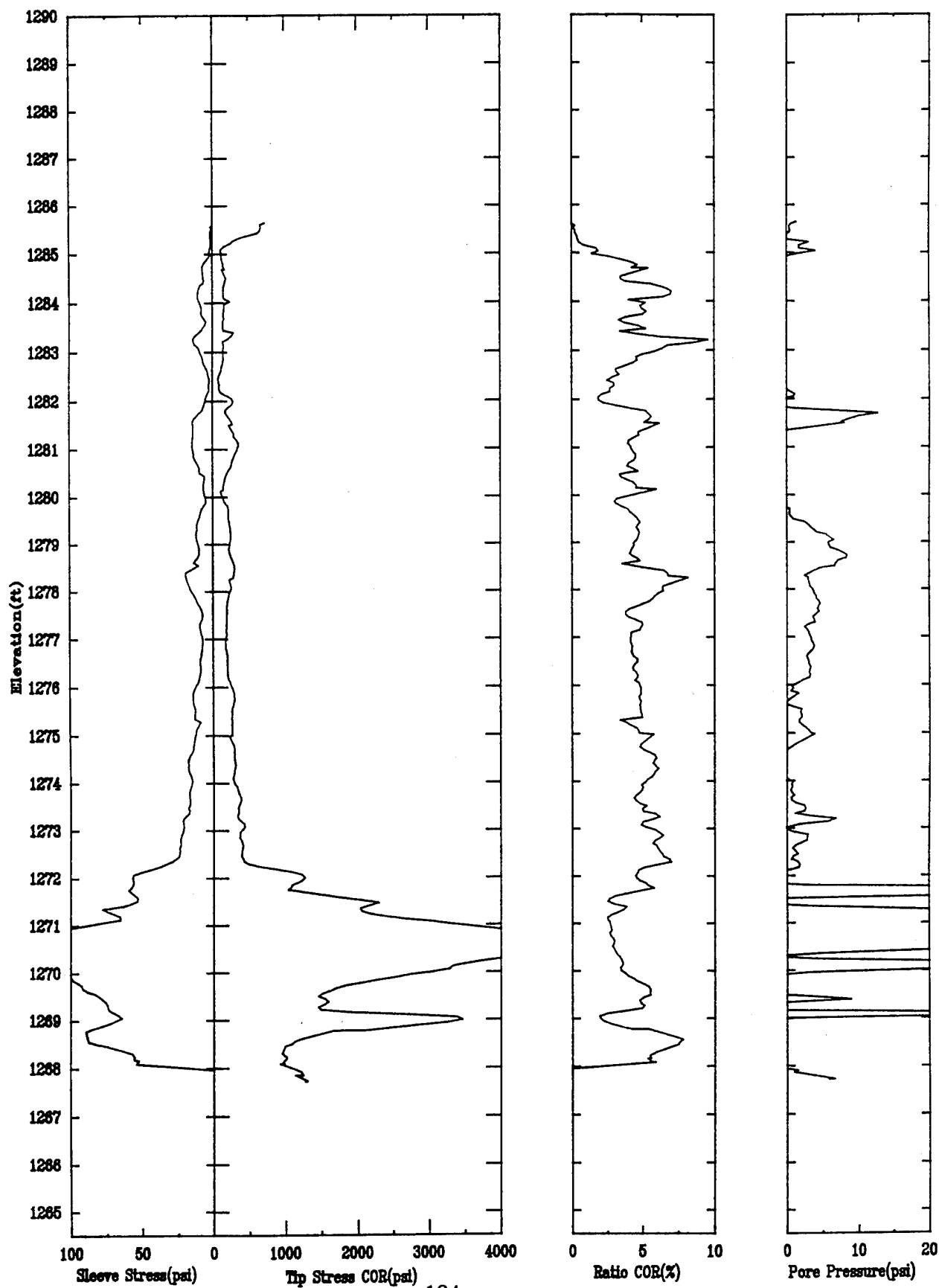
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 149424.

East 2185882.

Elevation 1285.8



FPA-40

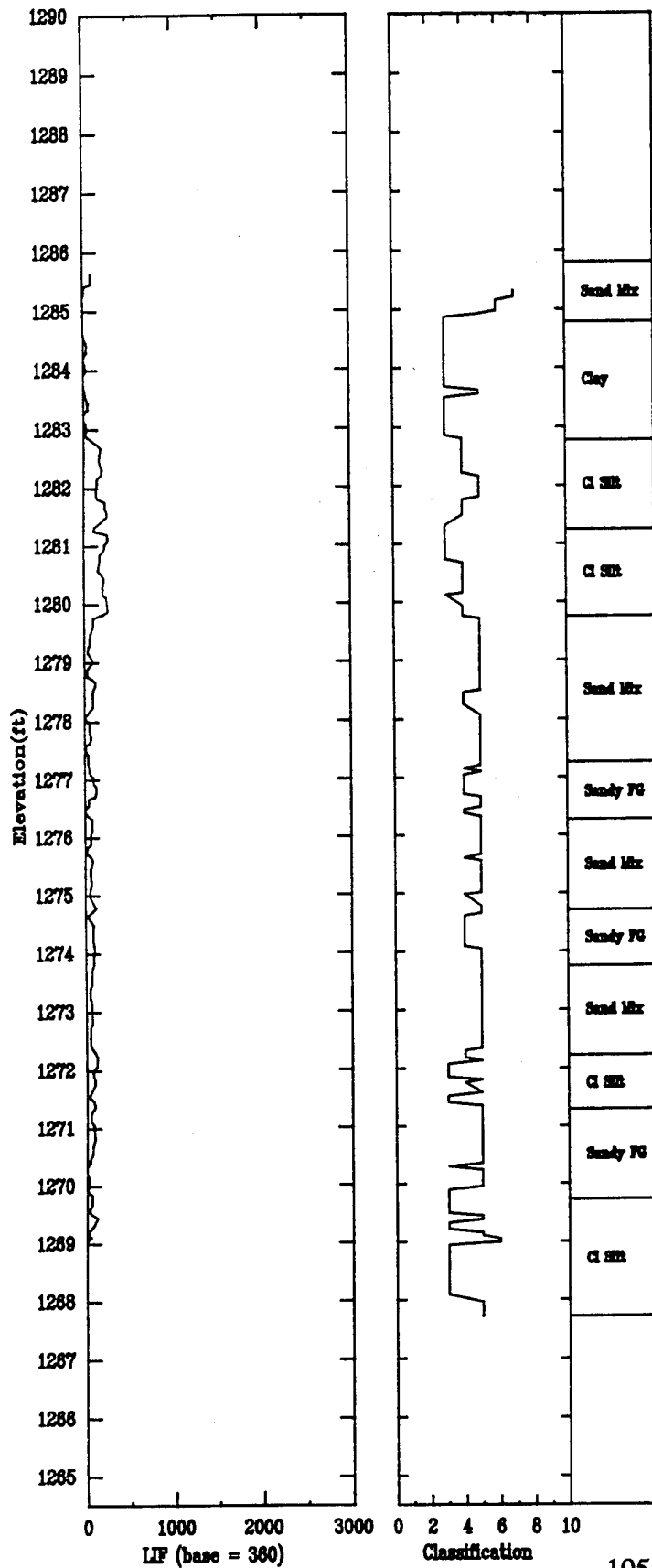
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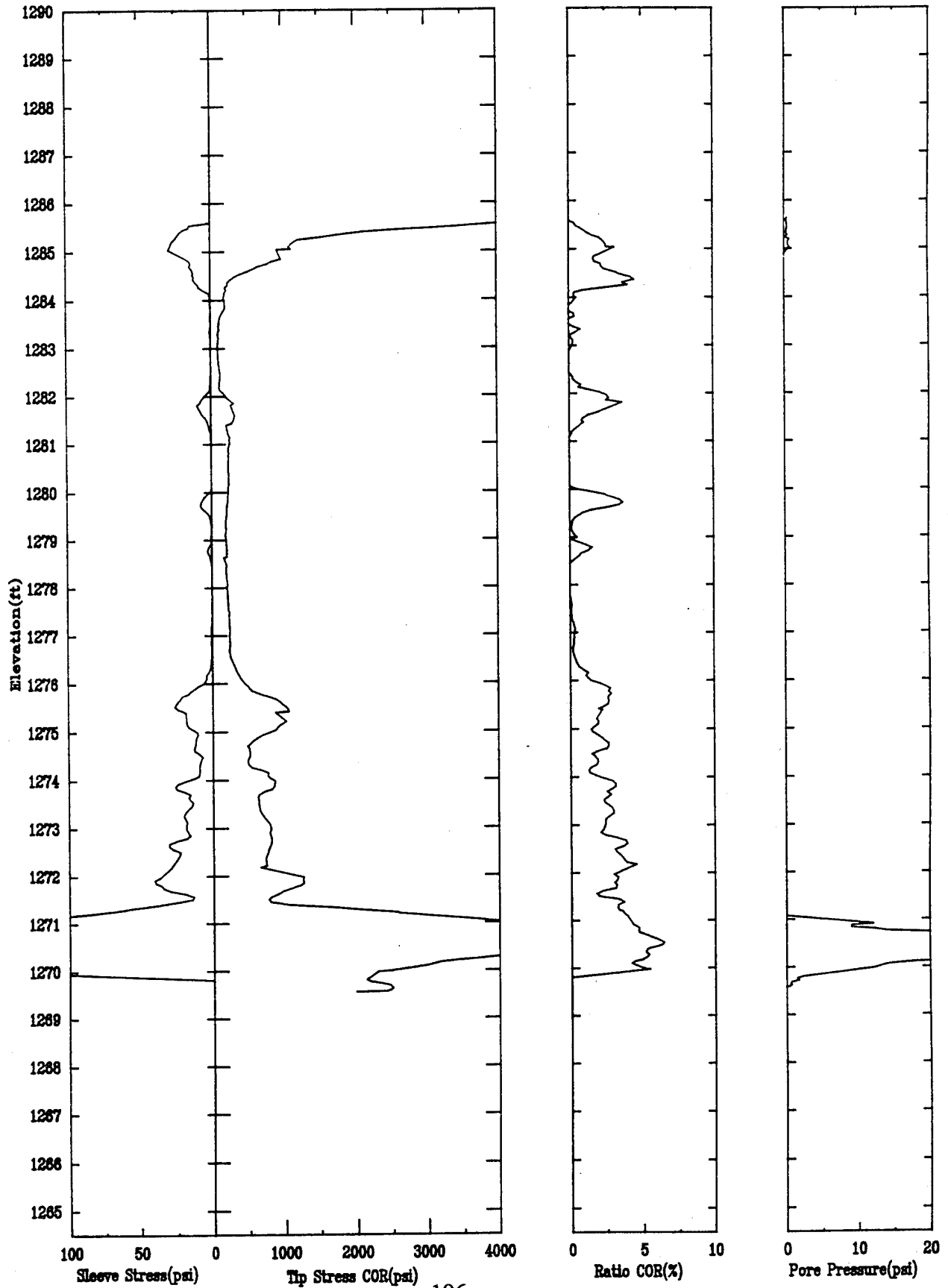
09/18/92

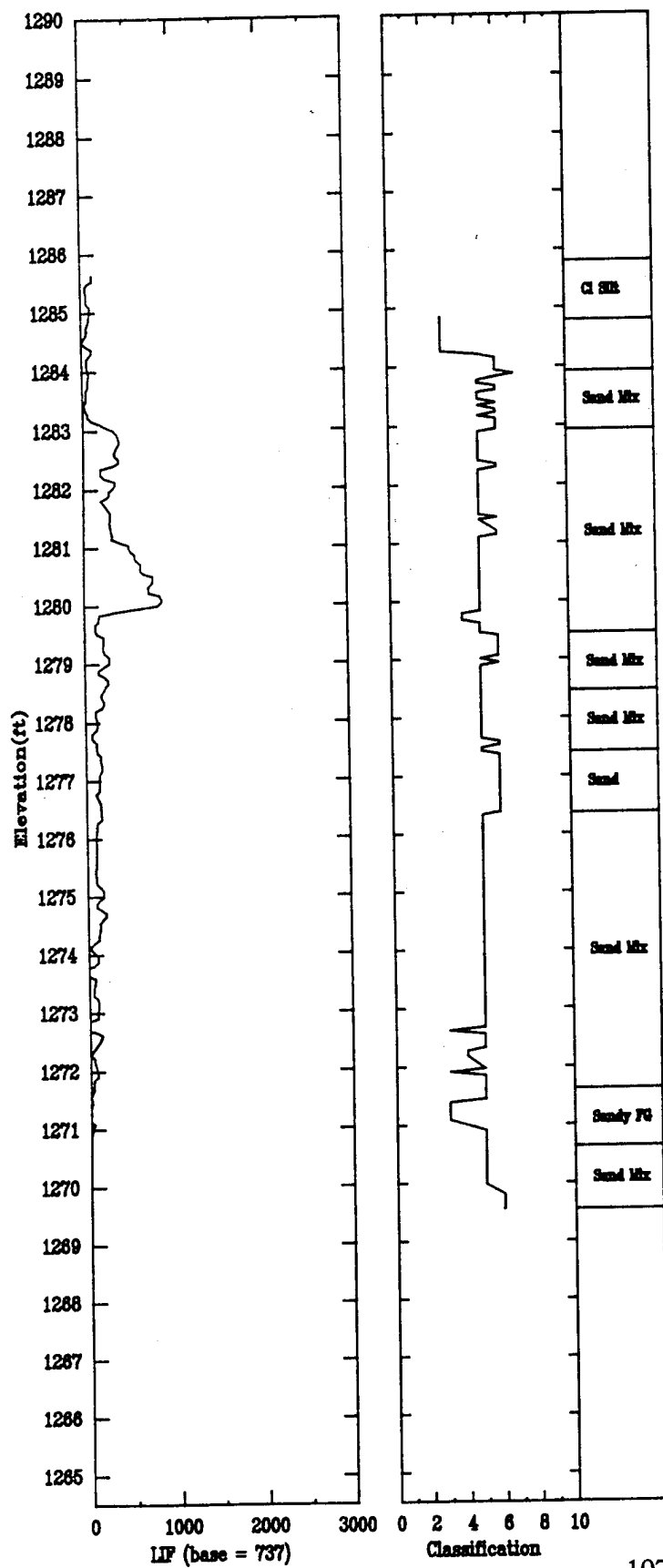
North 149424.

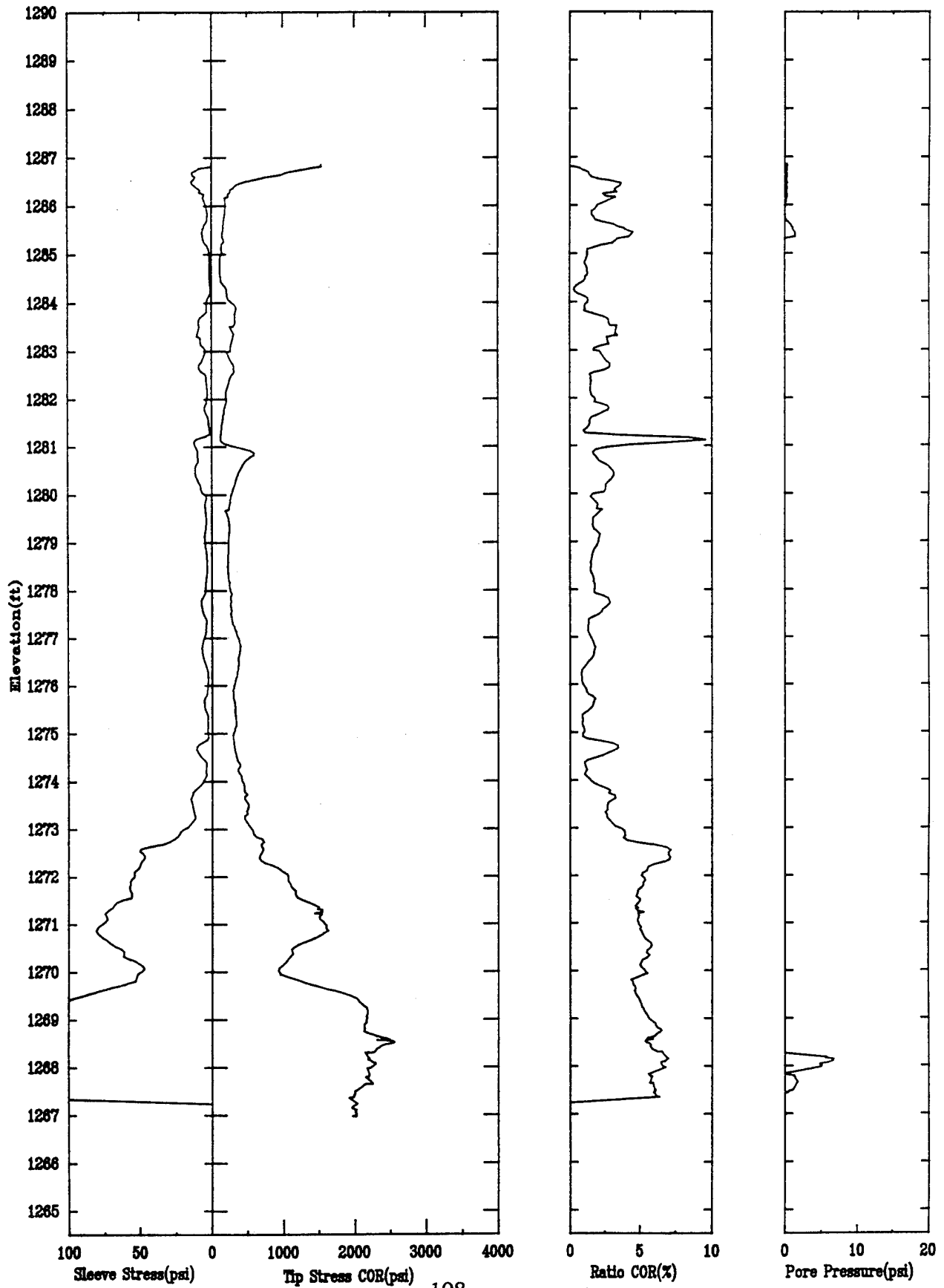
East 2185882.

Elevation 1285.8









FPA-42

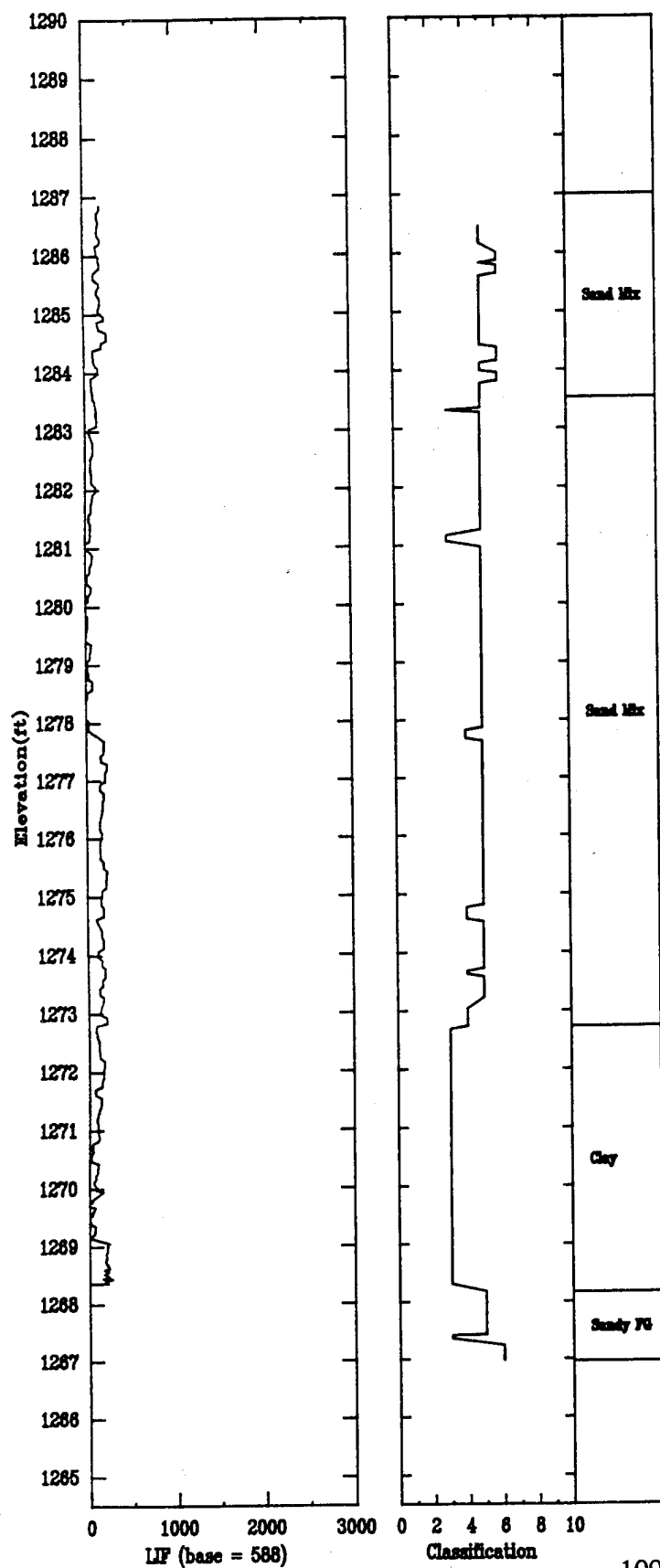
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 149520.

East 2185888.

Elevation 1287.0



FPA-43

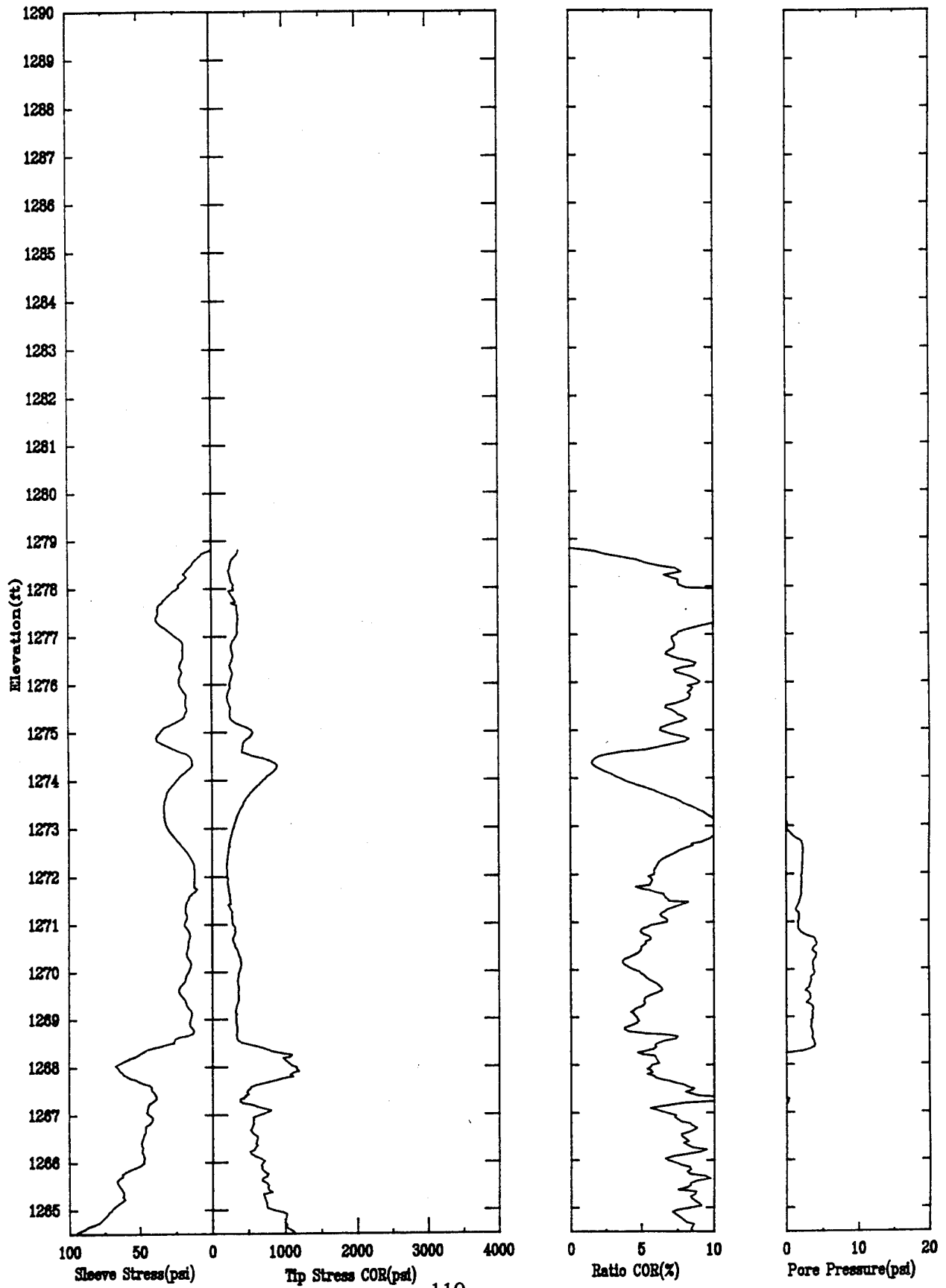
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 148983.

East 2185580.

Elevation 1279.0



FPA-43

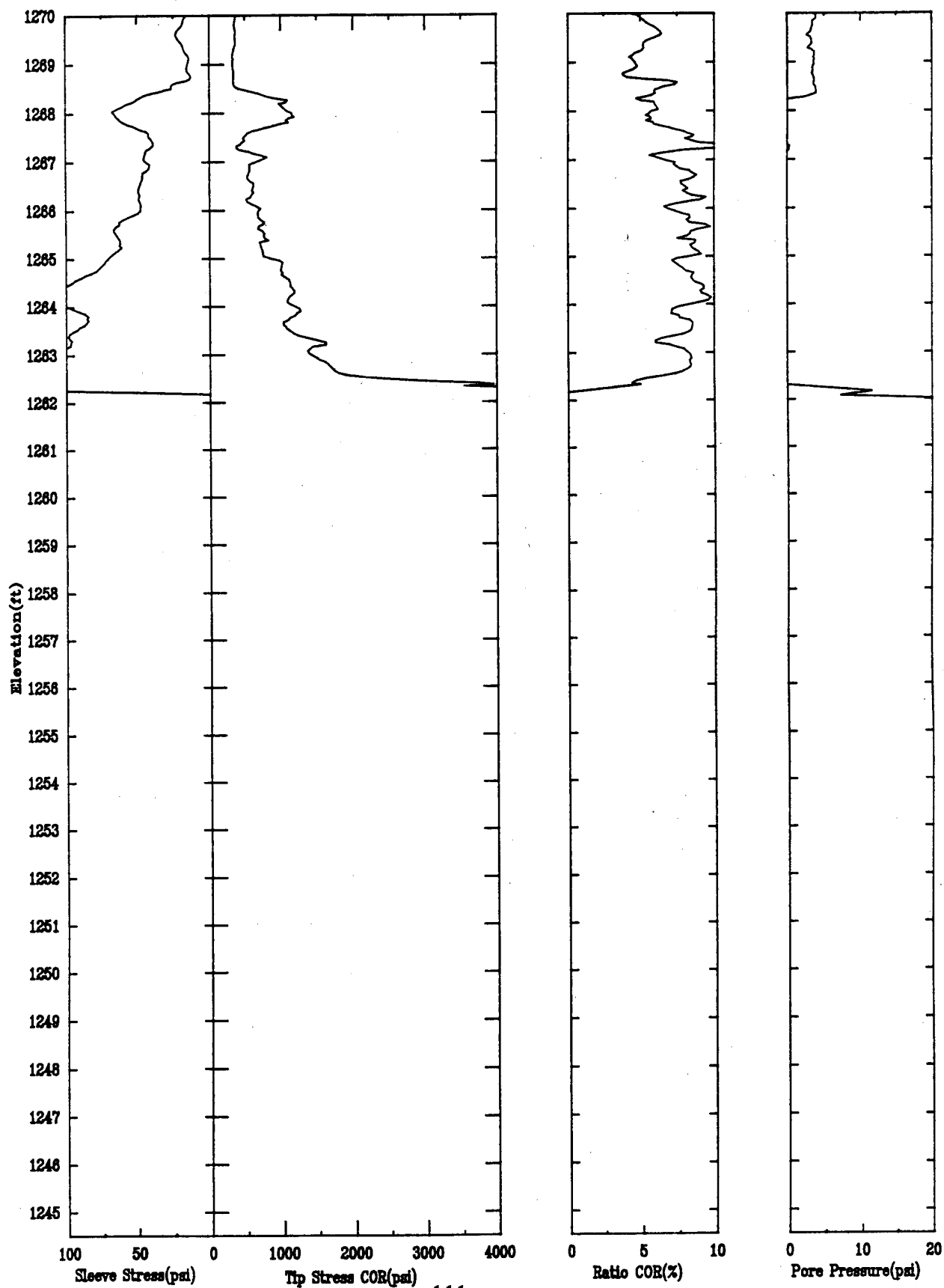
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 148983.

East 2185580.

Elevation 1279.0



FPA-43

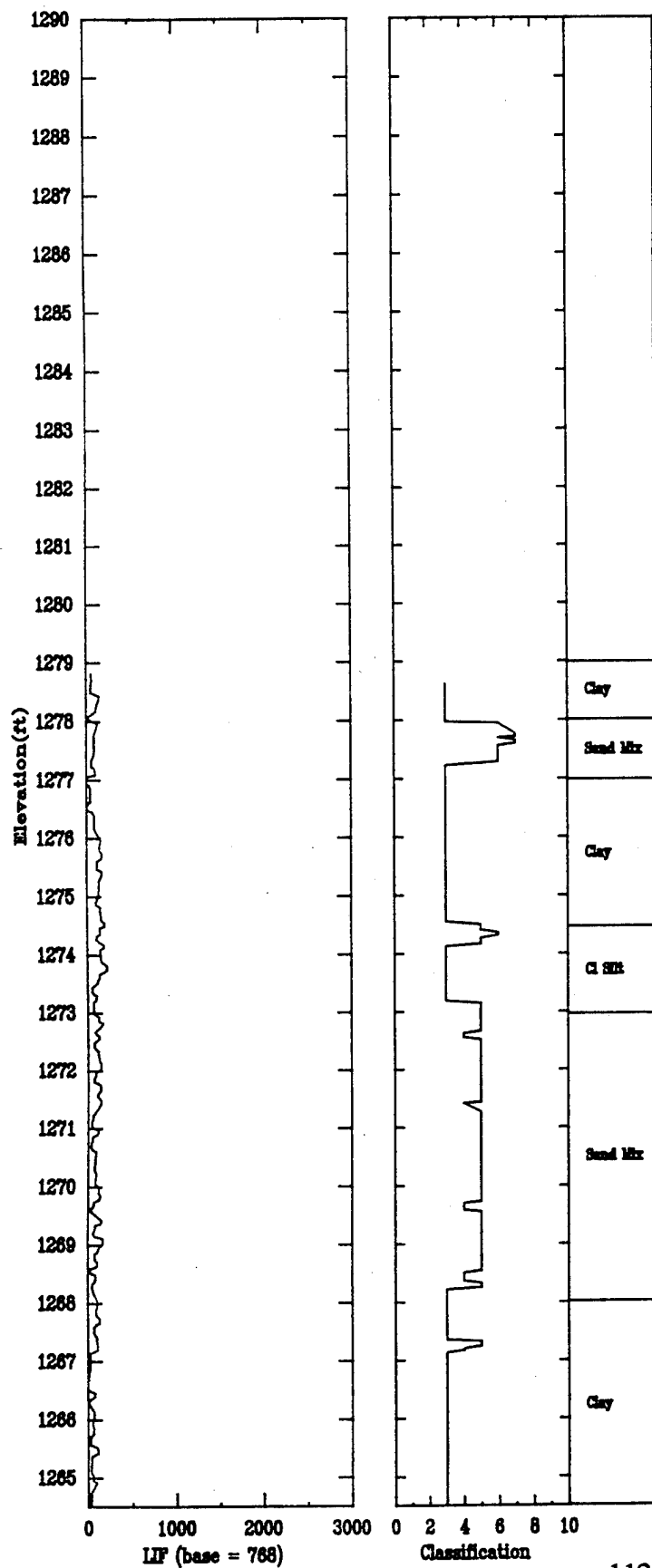
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 148983.

East 2185580.

Elevation 1279.0



FPA-43

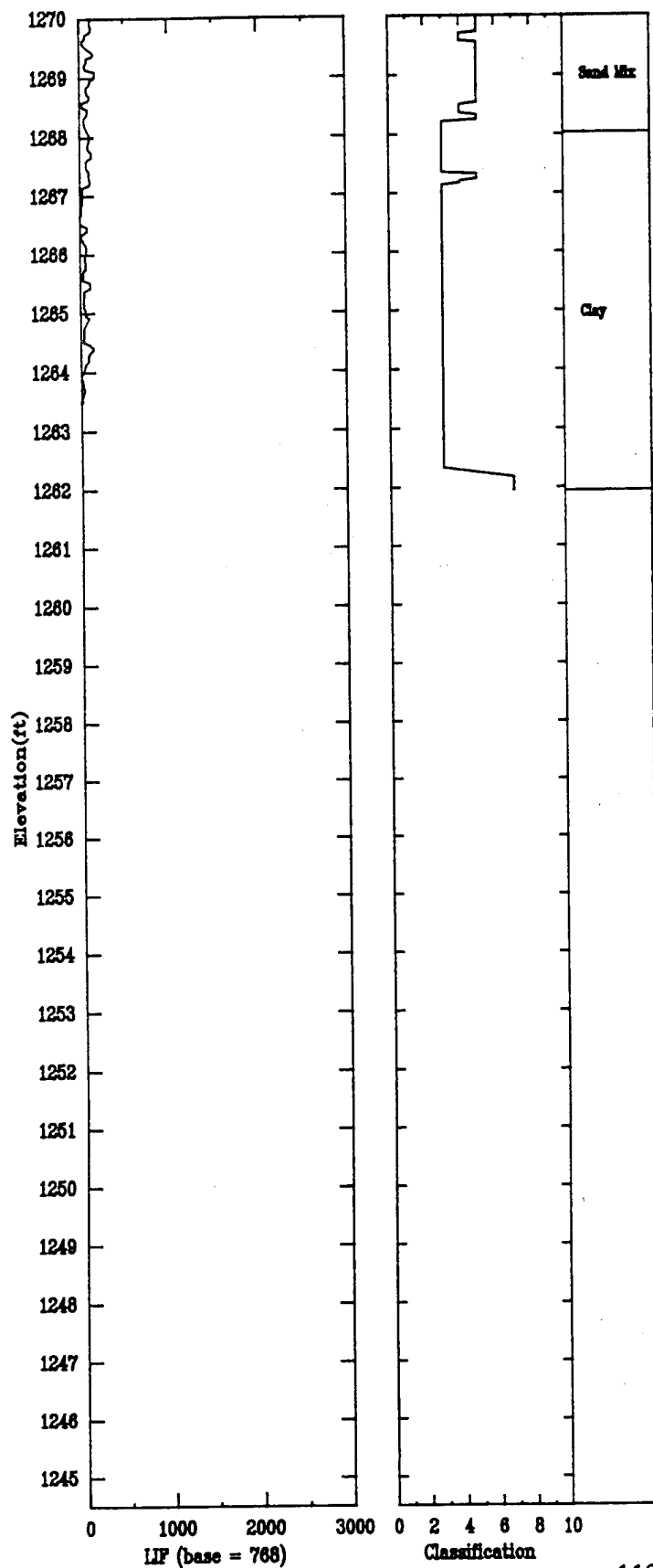
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 148983.

East 2185580.

Elevation 1279.0



FPA-44

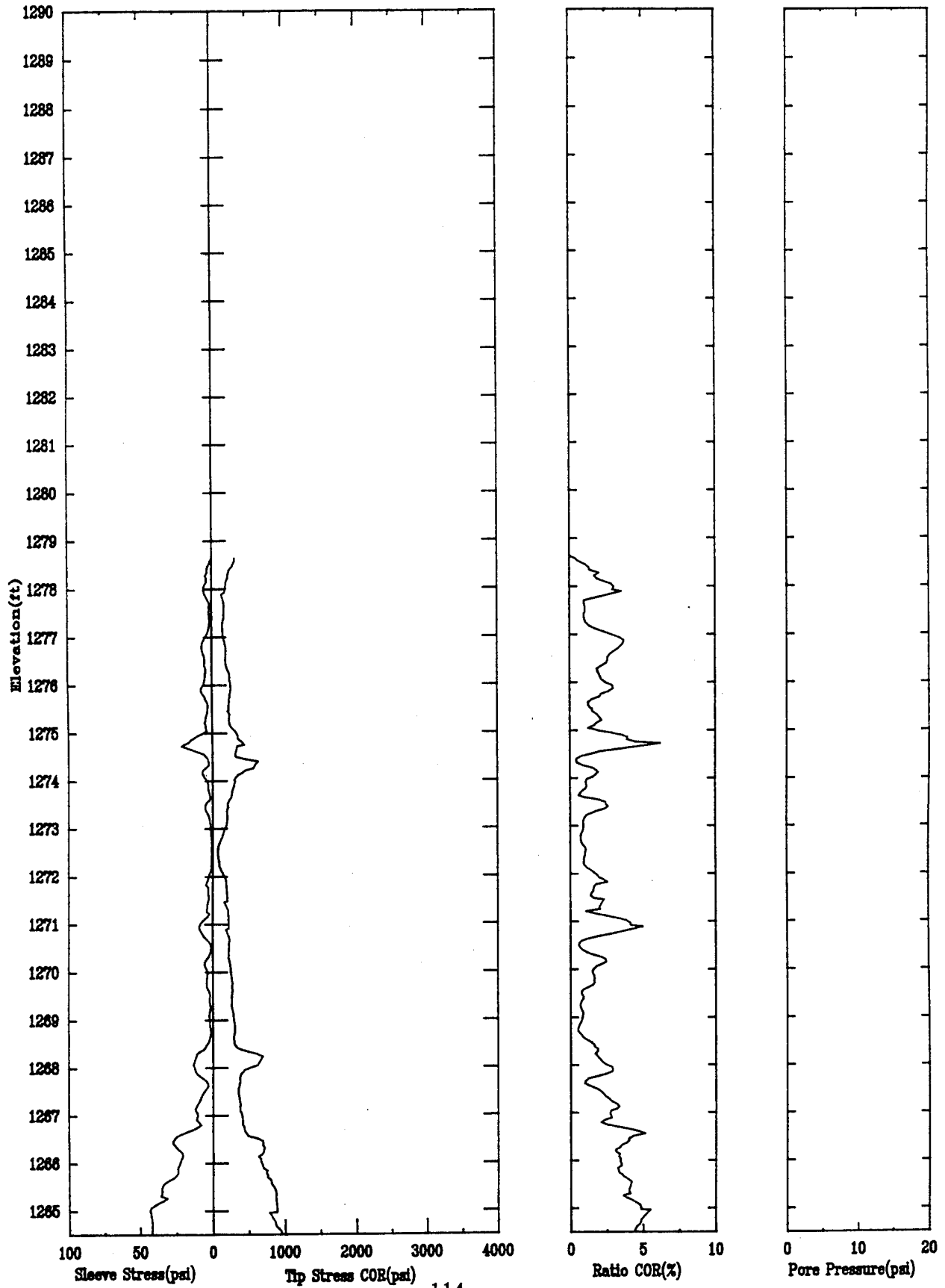
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 148971.

East 2185683.

Elevation 1278.8



FPA-44

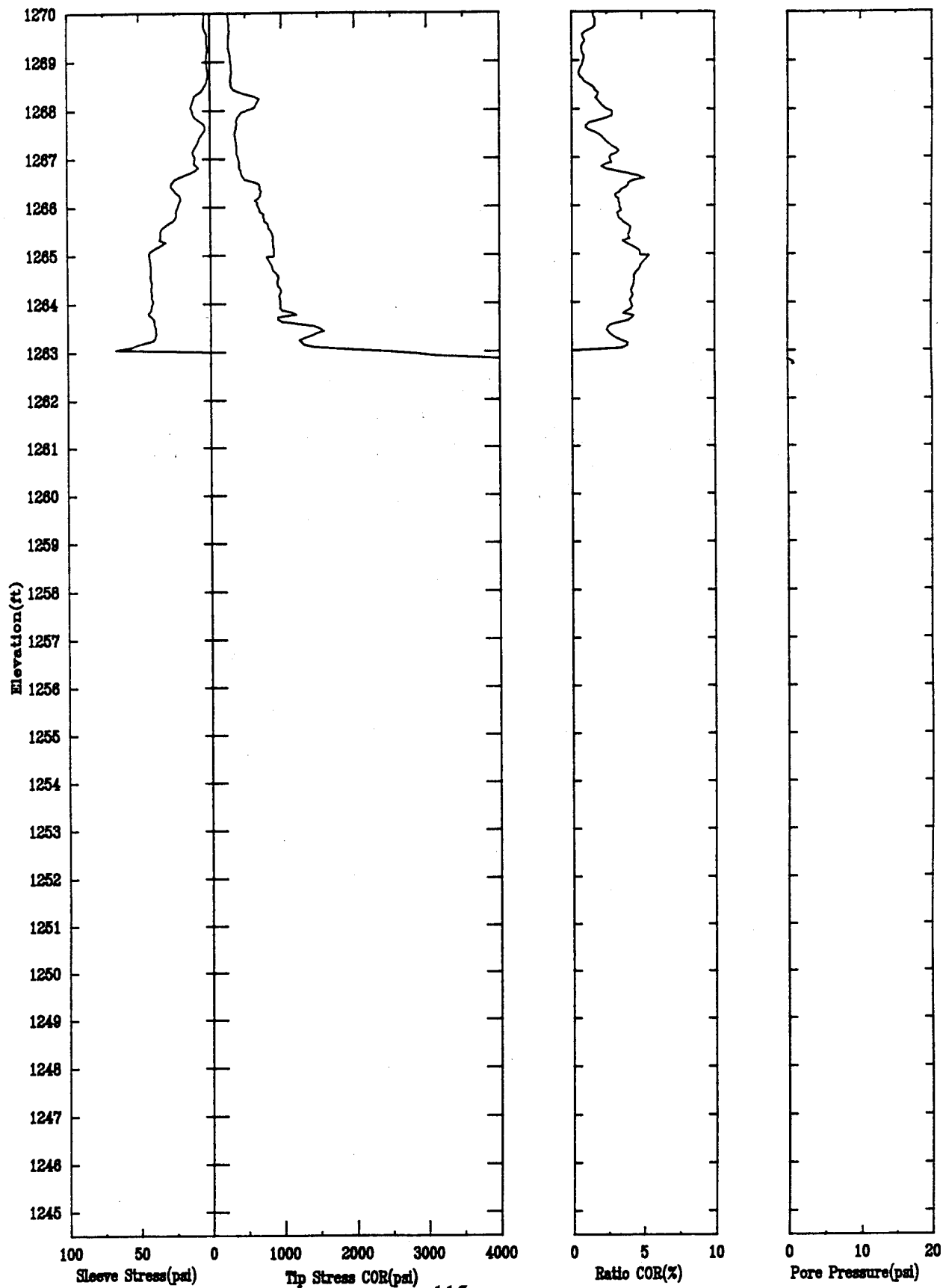
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 148971.

East 2185683.

Elevation 1278.8



FPA-44

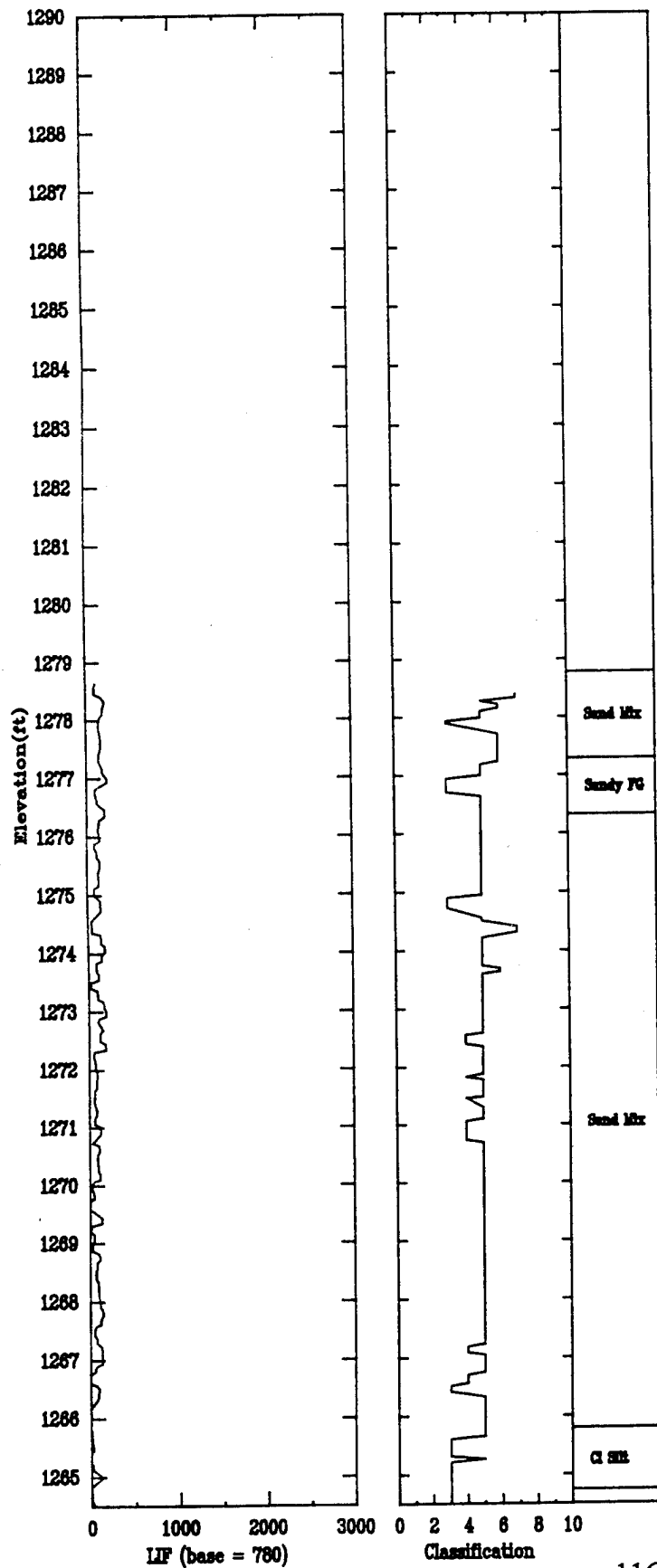
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 148971.

East 2185683.

Elevation 1278.8



FPA-44

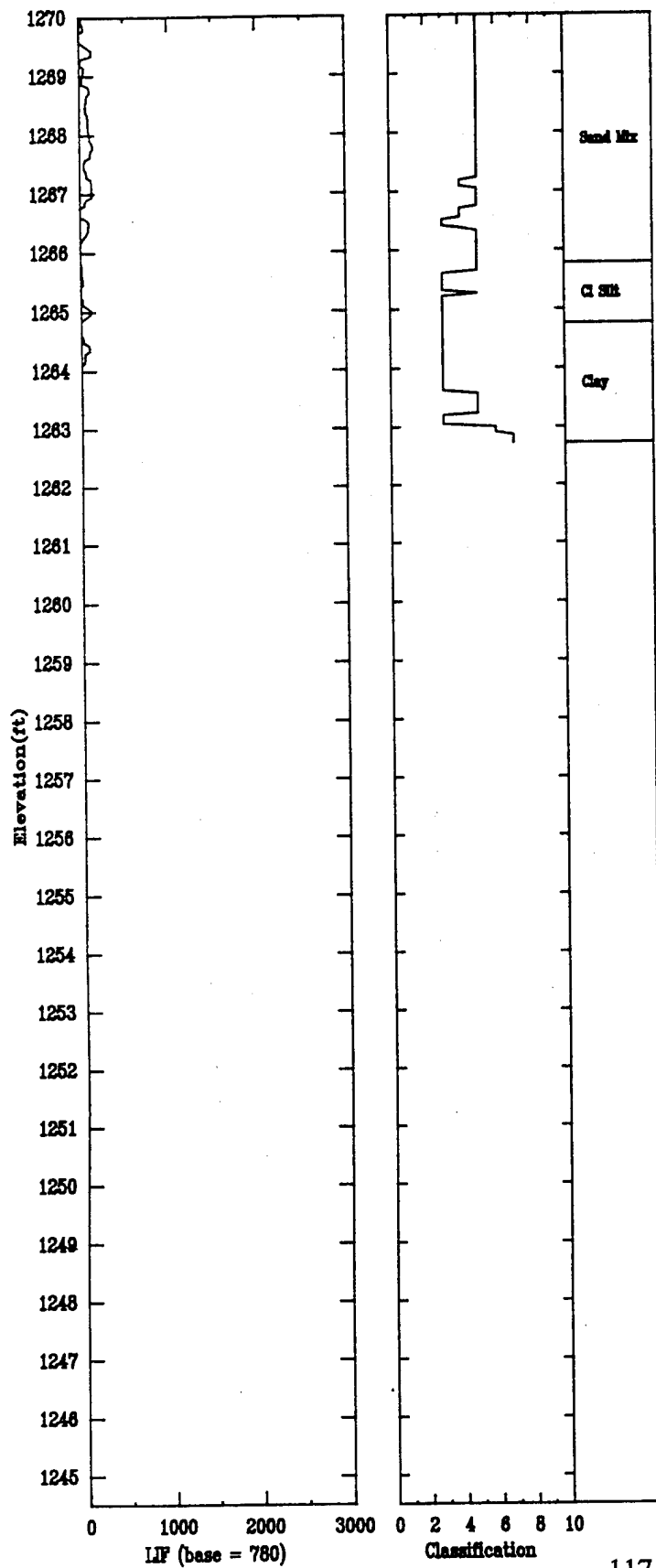
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 148971.

East 2185683.

Elevation 1278.8



FPA-45

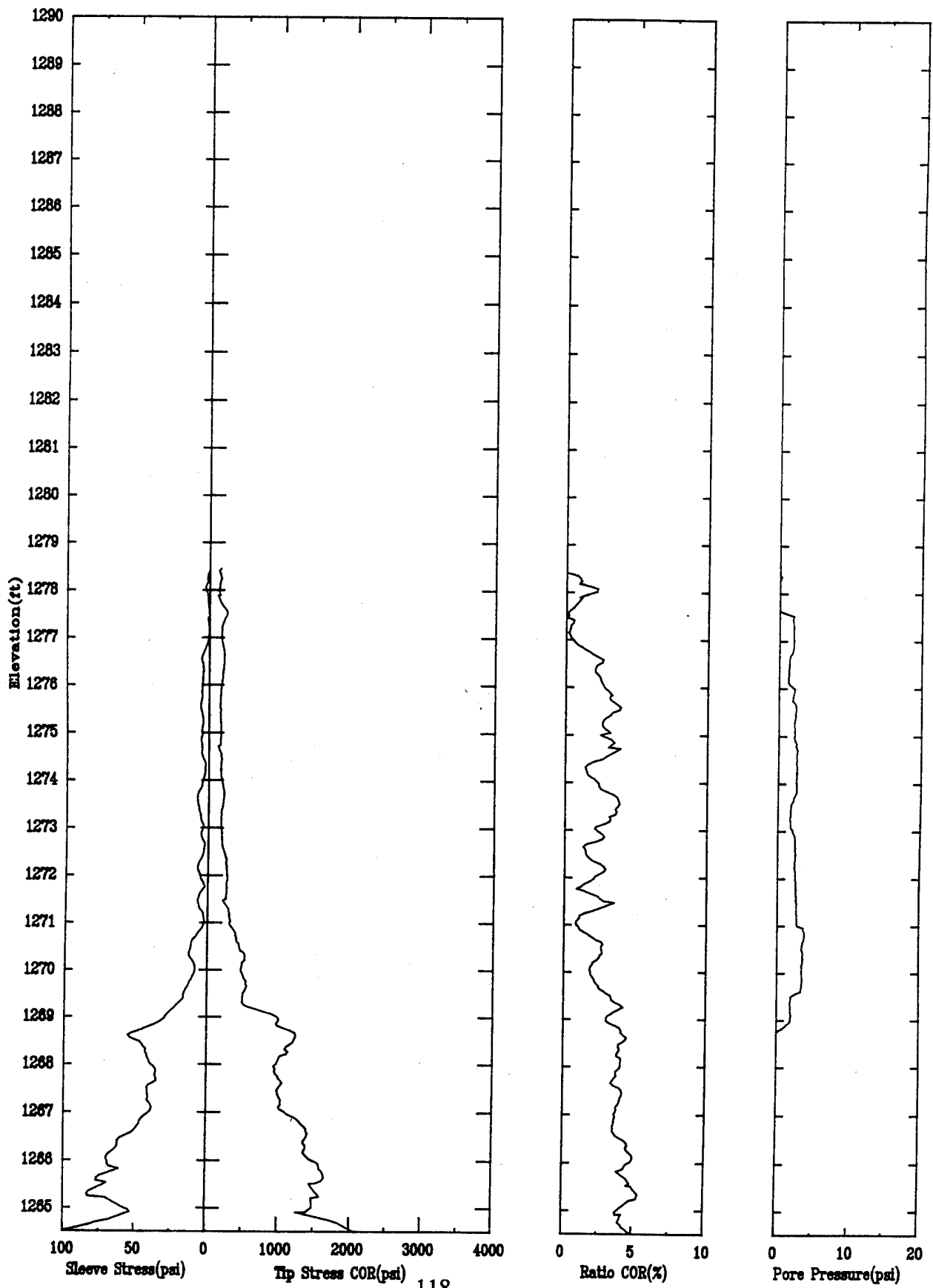
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 149120.

East 2185534.

Elevation 1278.6



FPA-45

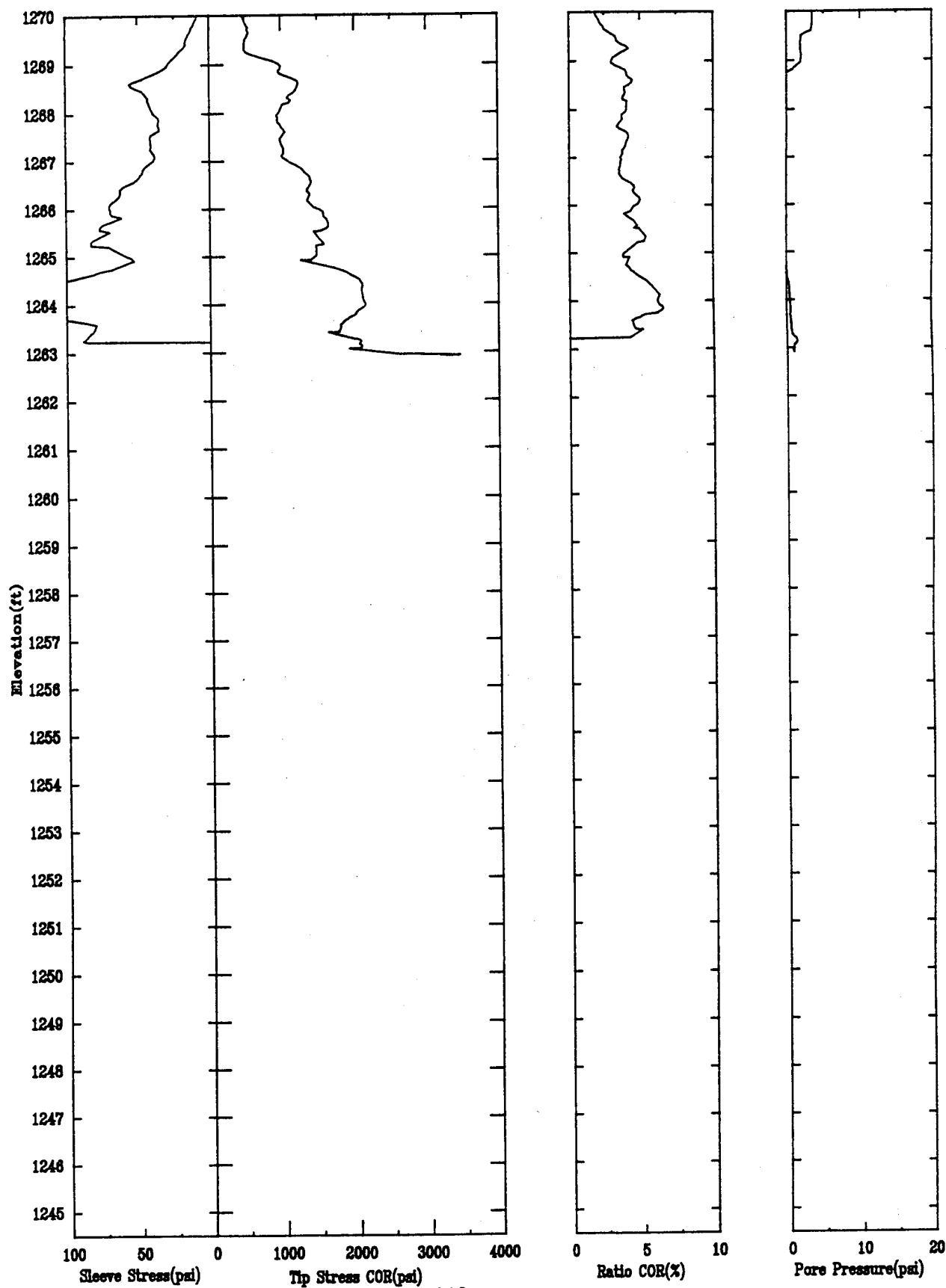
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 149120.

East 2185534.

Elevation 1278.6



FPA-45

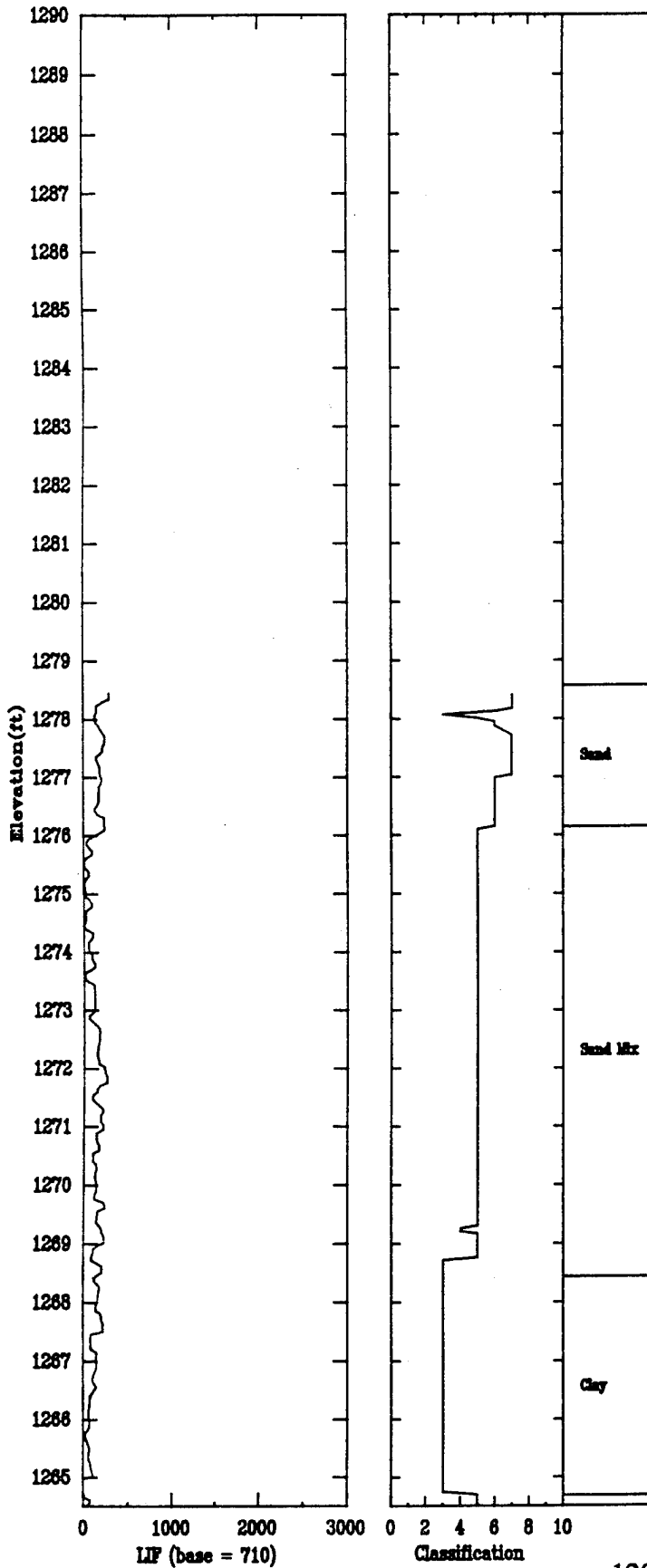
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 149120.

East 2185534.

Elevation 1278.6



FPA-45

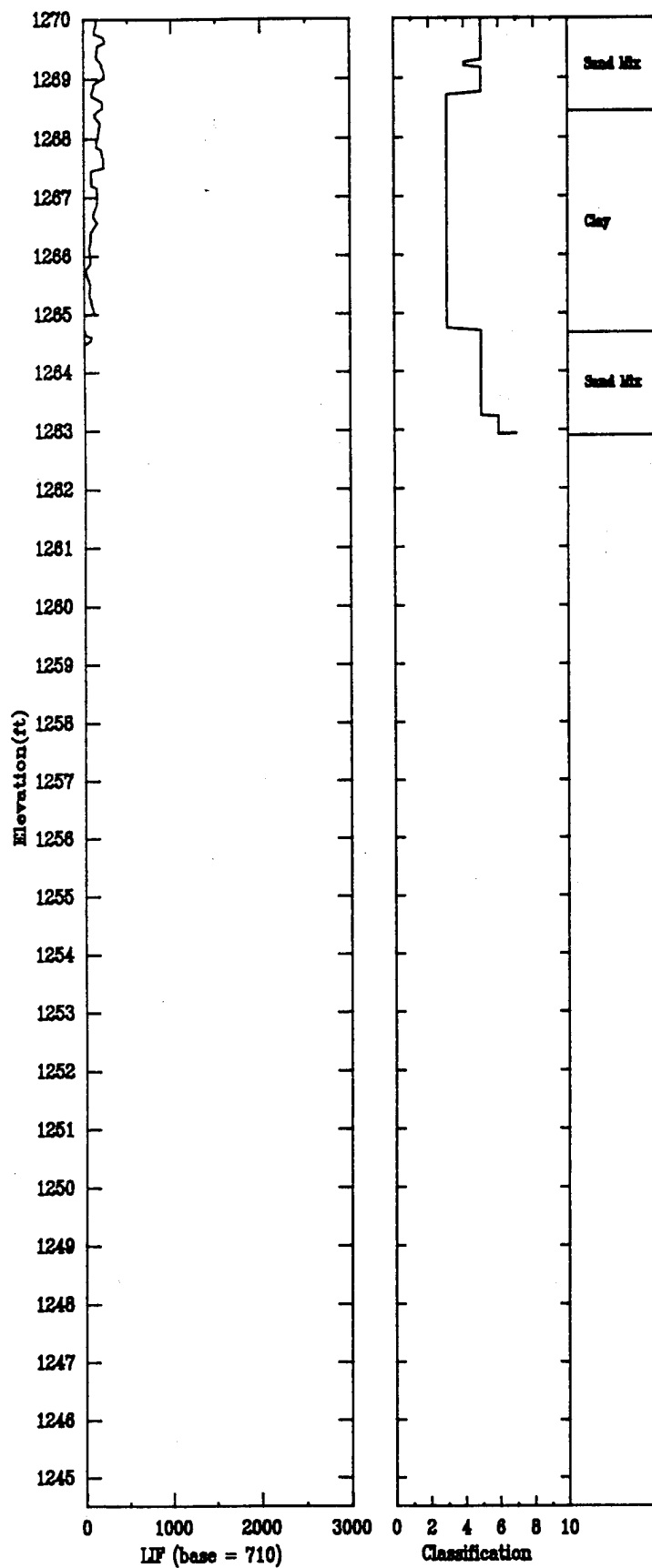
APPLIED RESEARCH ASSOCIATES, INC.

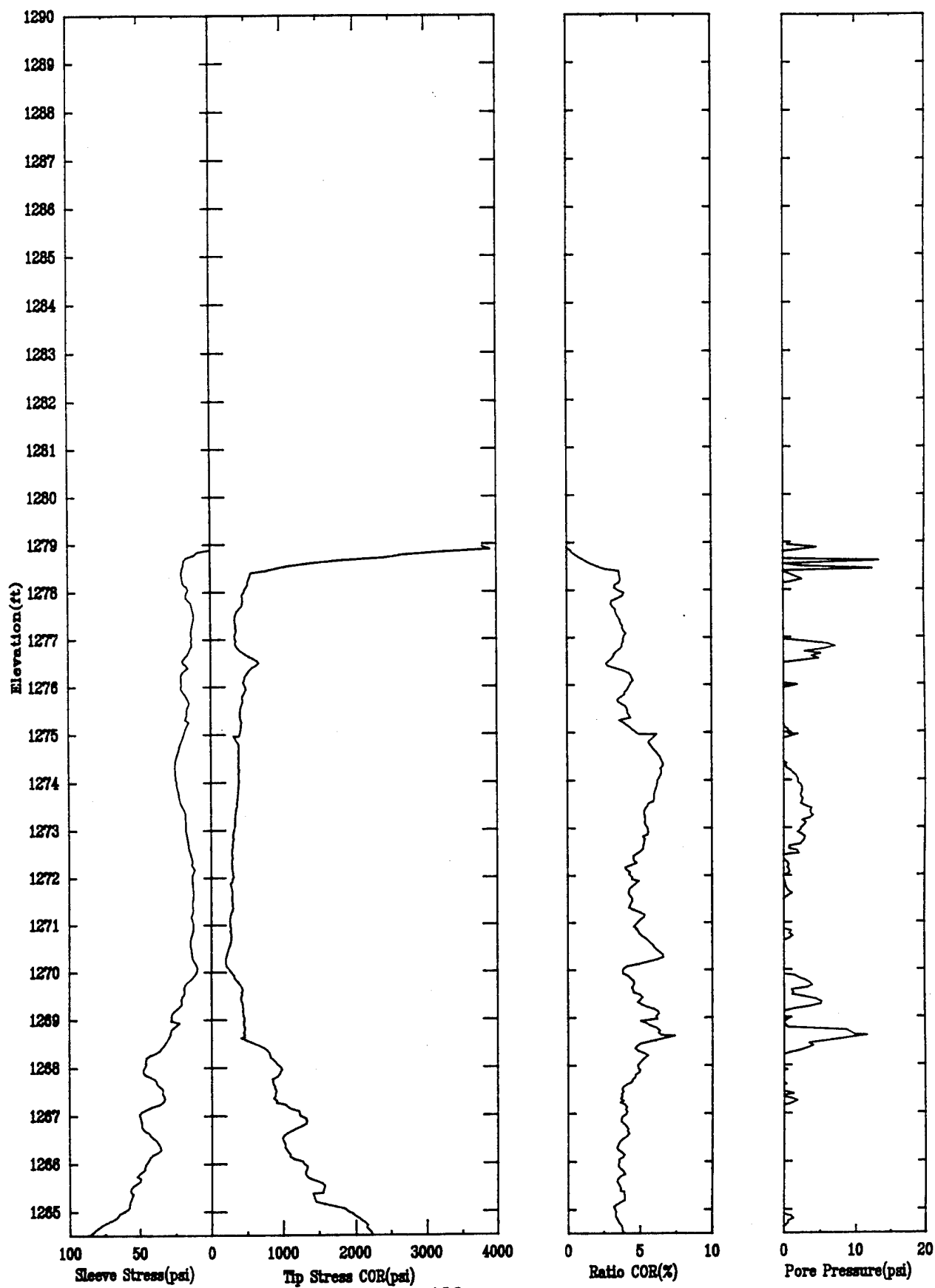
09/18/92

North 149120.

East 2185534.

Elevation 1278.6





FPA-46

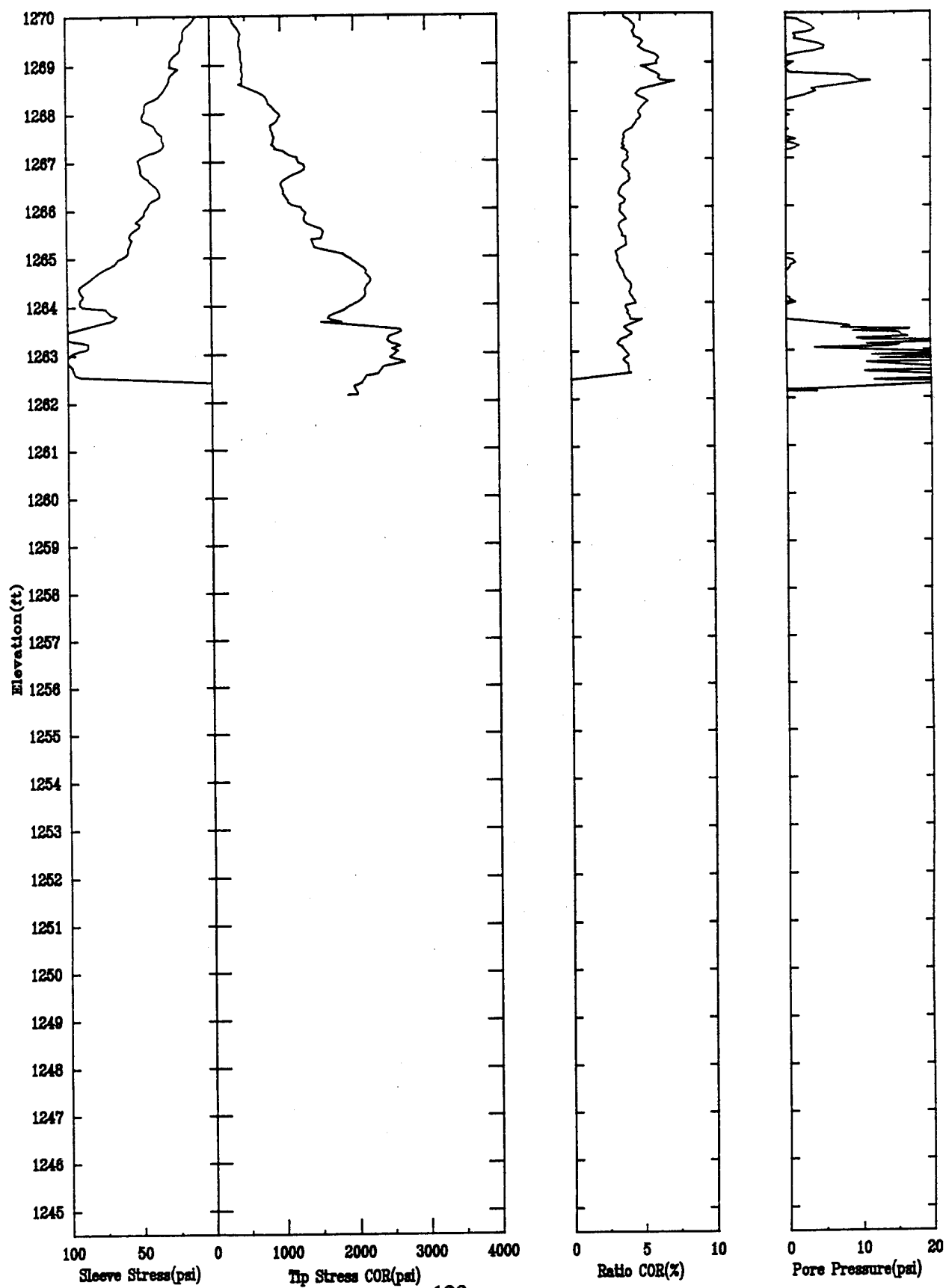
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 149047.

East 2185487.

Elevation 1279.1



FPA-46

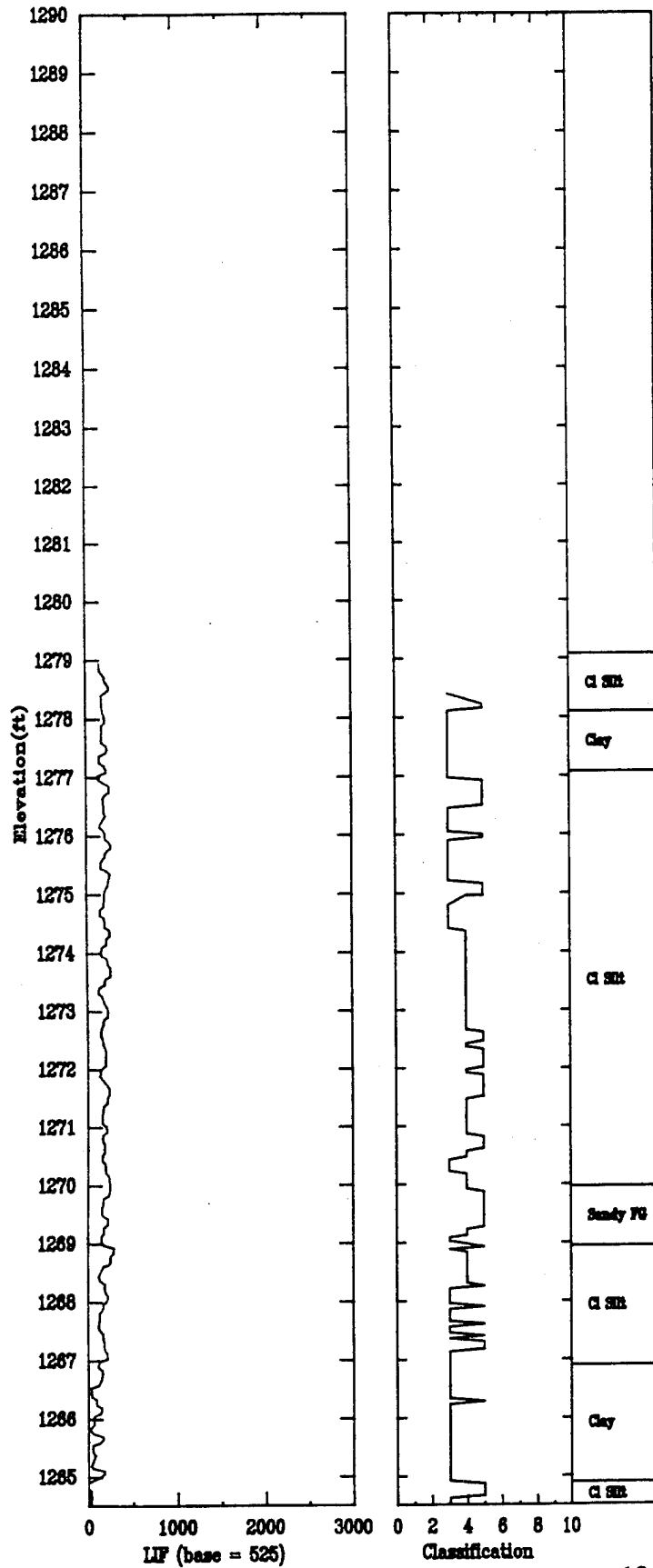
APPLIED RESEARCH ASSOCIATES, INC.

09/18/92

North 149047.

East 2185487.

Elevation 1279.1



FPA-46

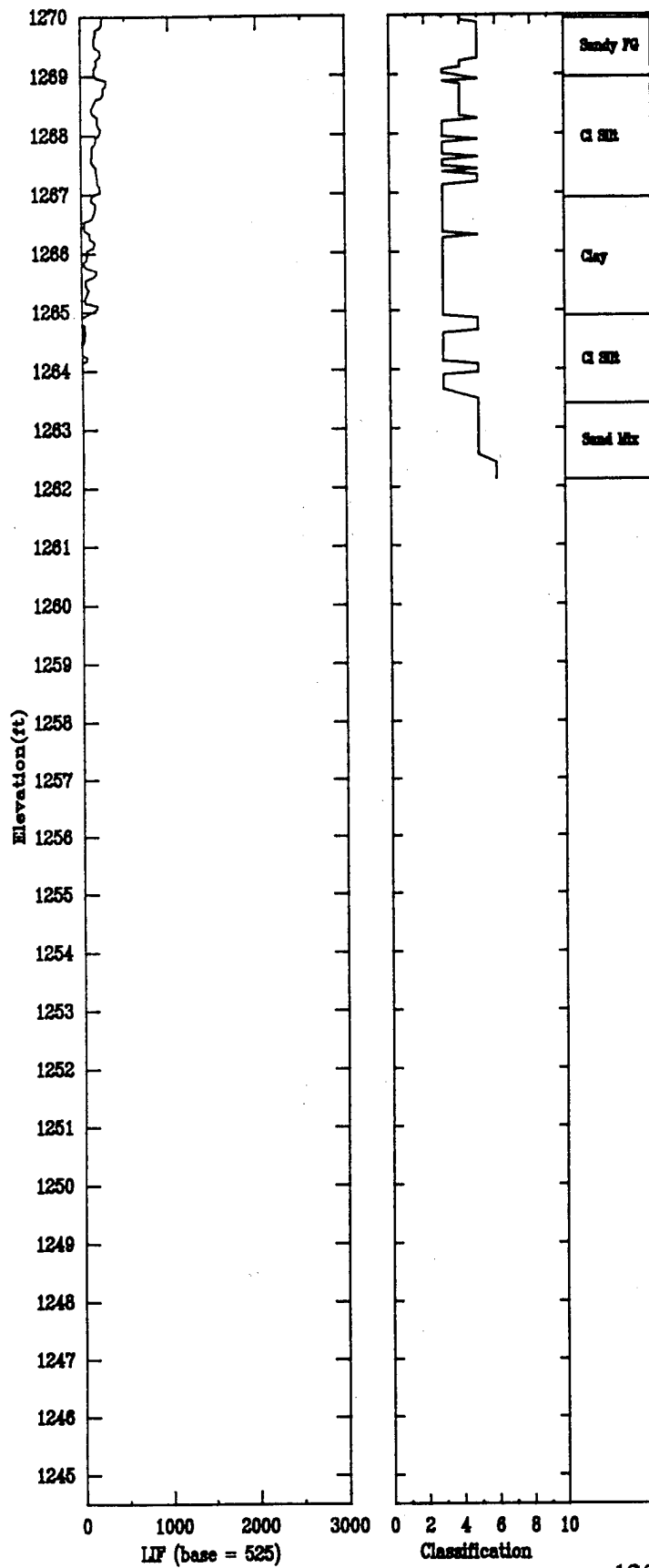
APPLIED RESEARCH ASSOCIATES, INC.

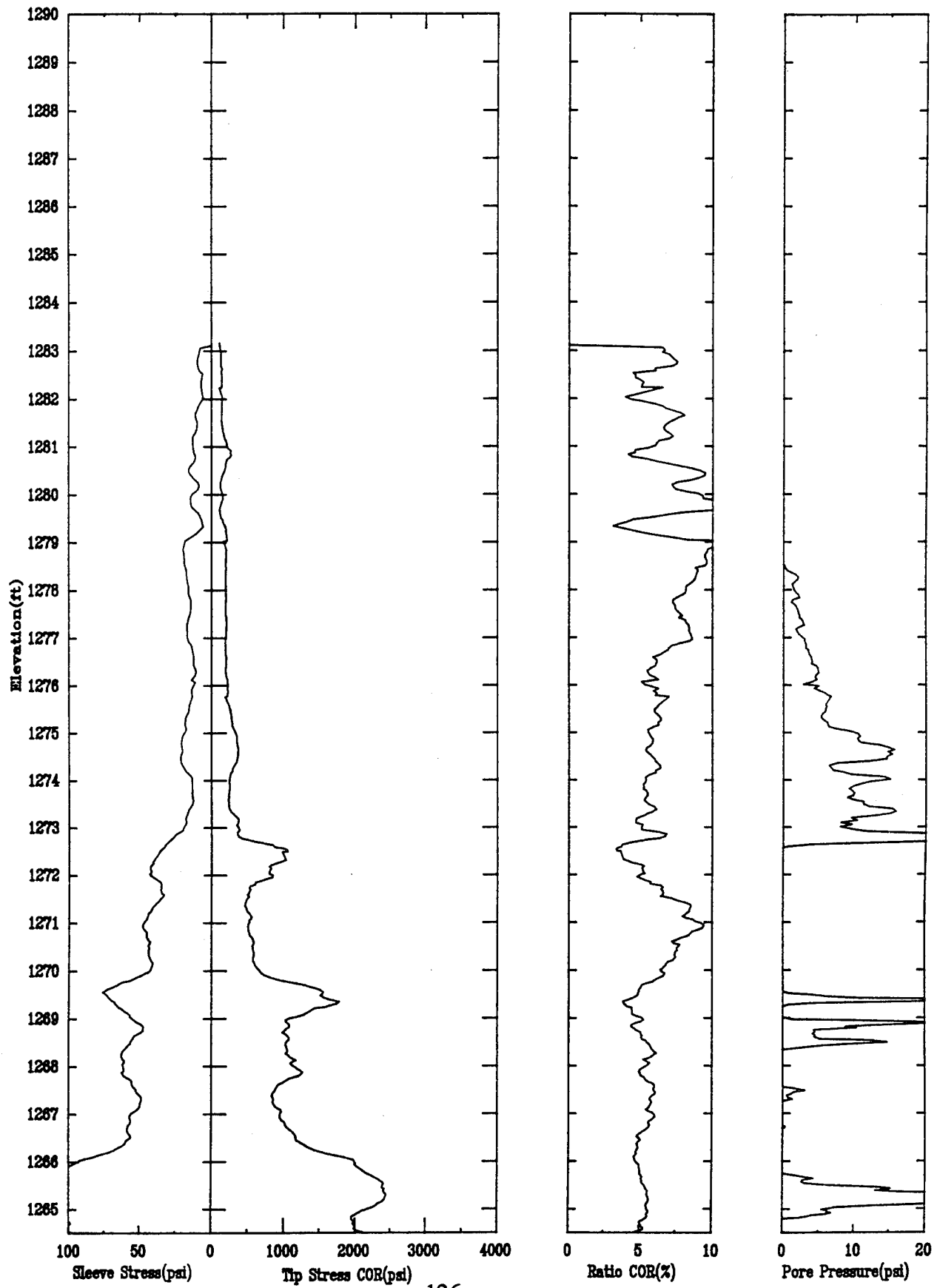
09/18/92

North 149047.

East 2185487.

Elevation 1279.1





FPA-47

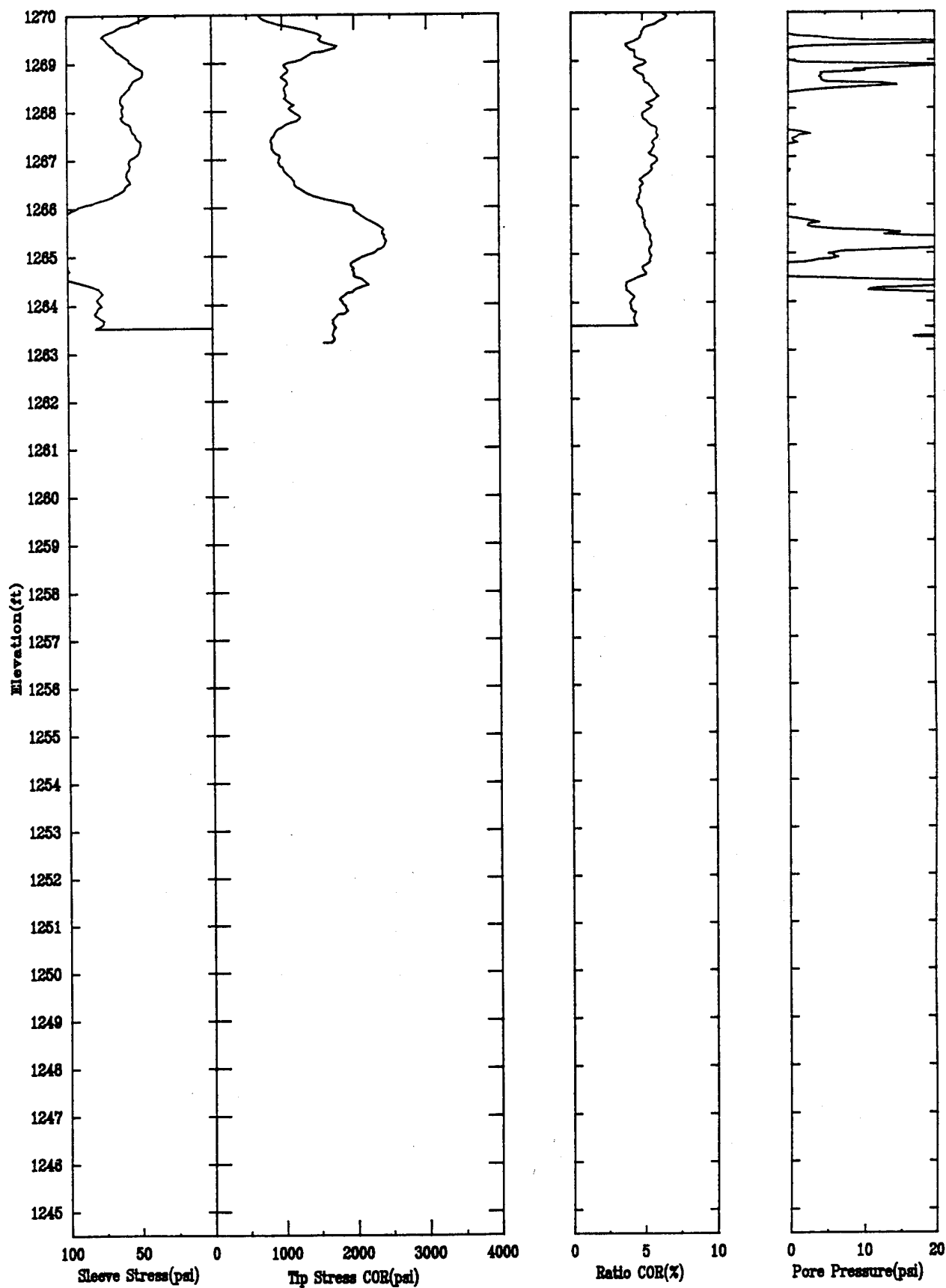
APPLIED RESEARCH ASSOCIATES, INC.

09/21/92

North 149264.

East 2185562.

Elevation 1283.3



FPA-47

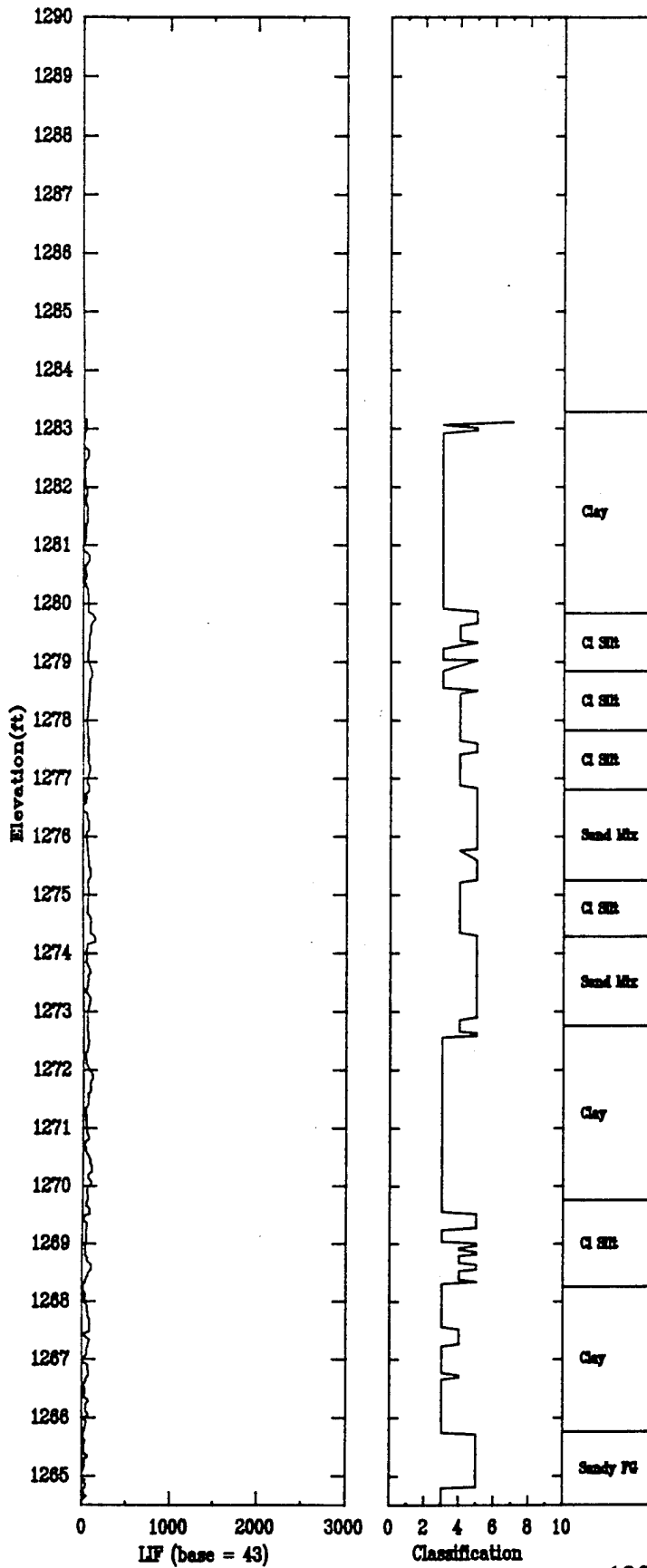
APPLIED RESEARCH ASSOCIATES, INC.

09/21/92

North 149264.

East 2185562.

Elevation 1283.3



FPA-47

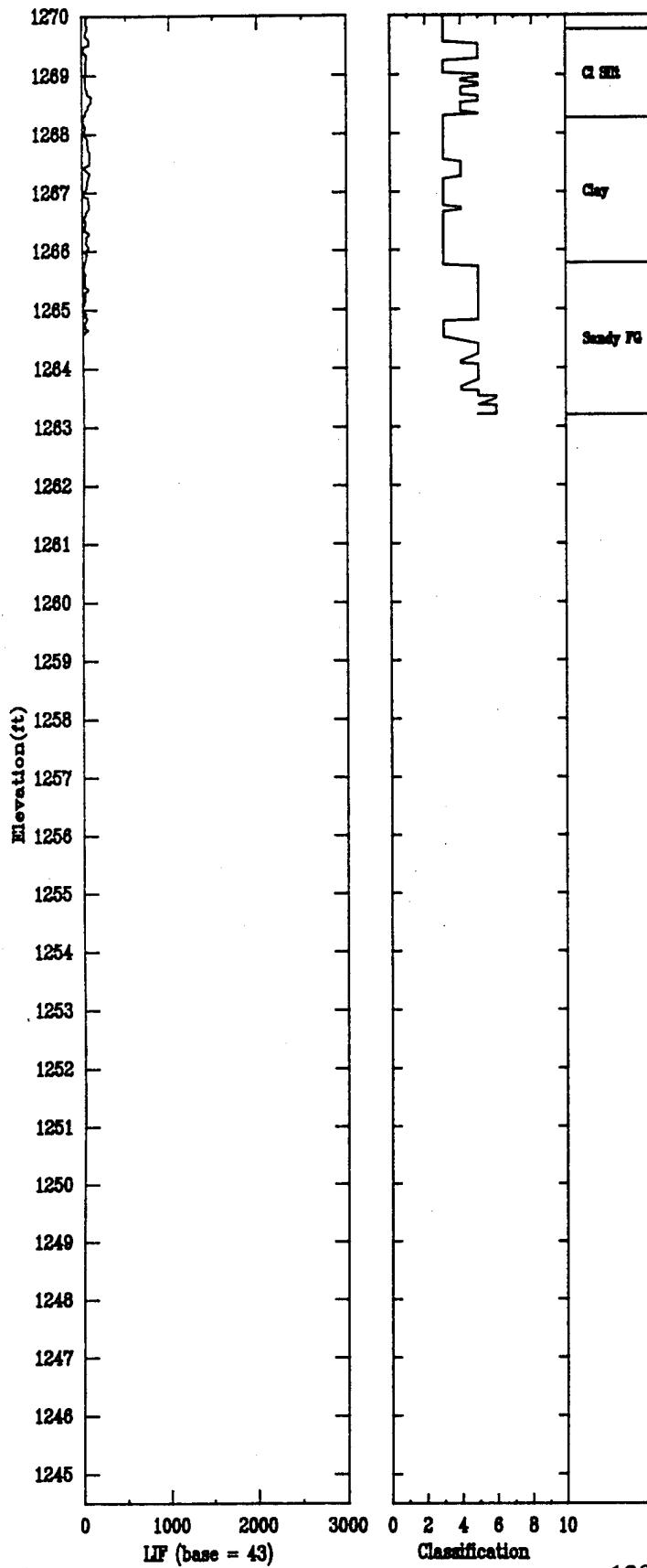
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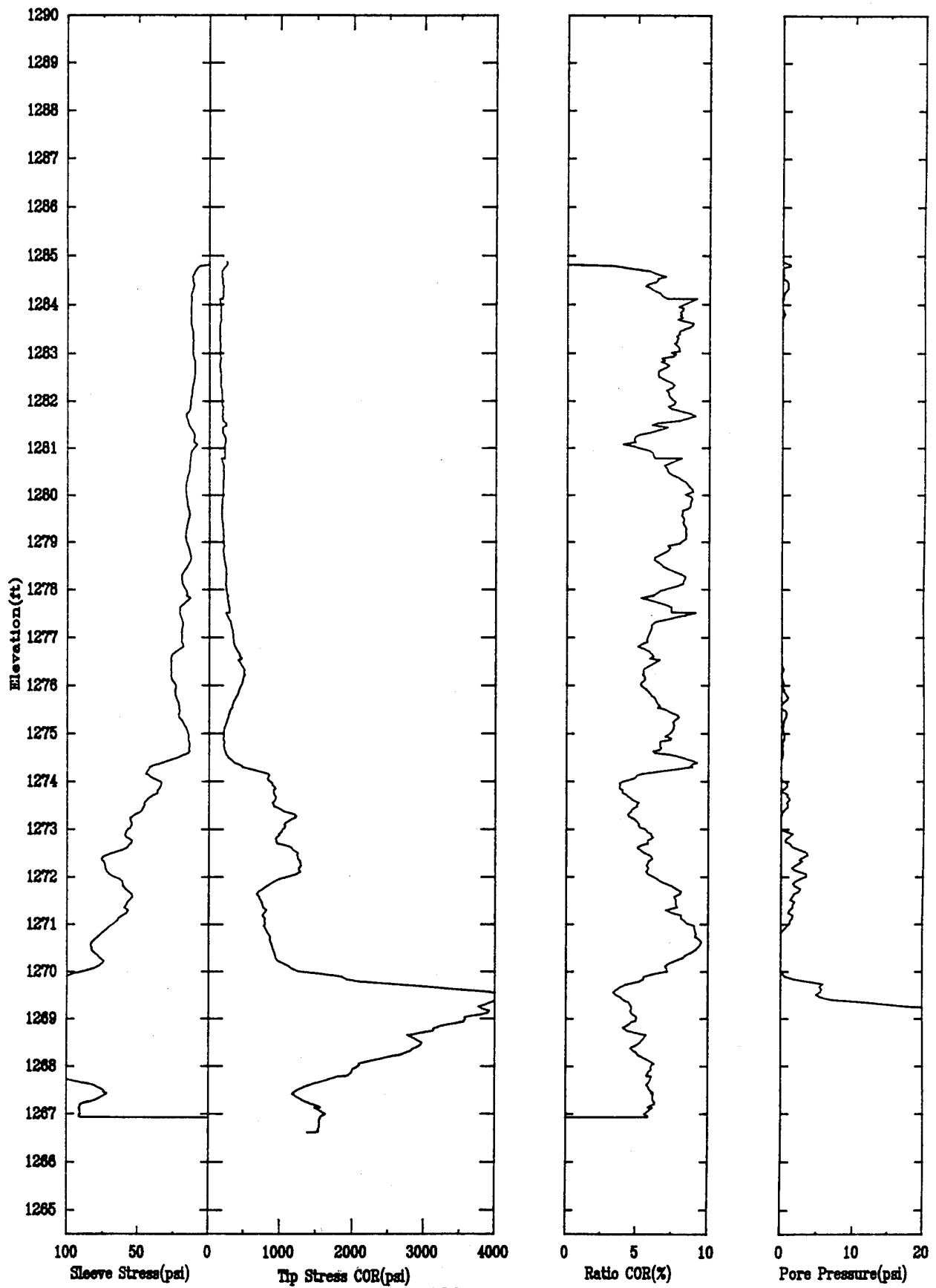
09/21/92

North 149264.

East 2185562.

Elevation 1283.3





FPA-48

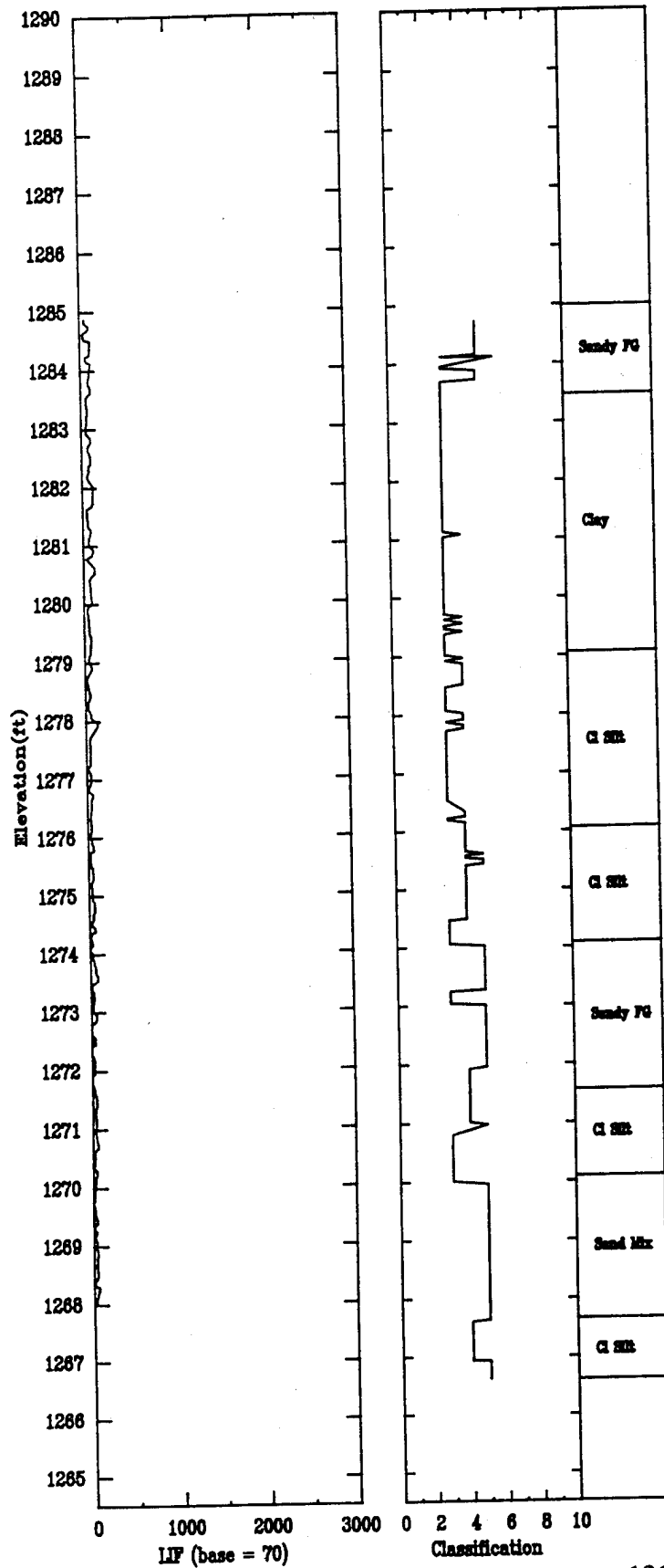
APPLIED RESEARCH ASSOCIATES, INC.

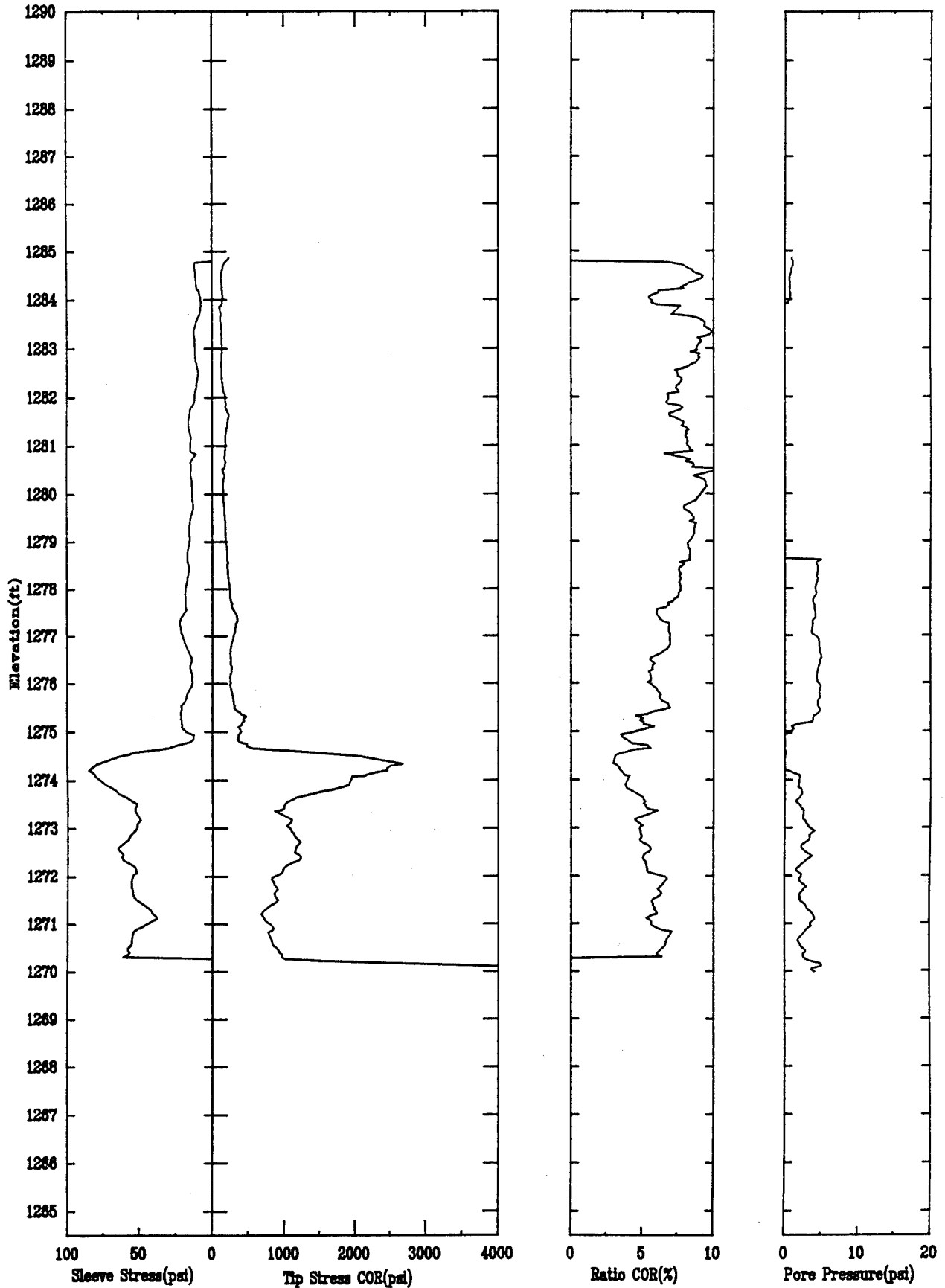
09/21/92

North 149361.

East 2185569.

Elevation 1285.0





FPA-49

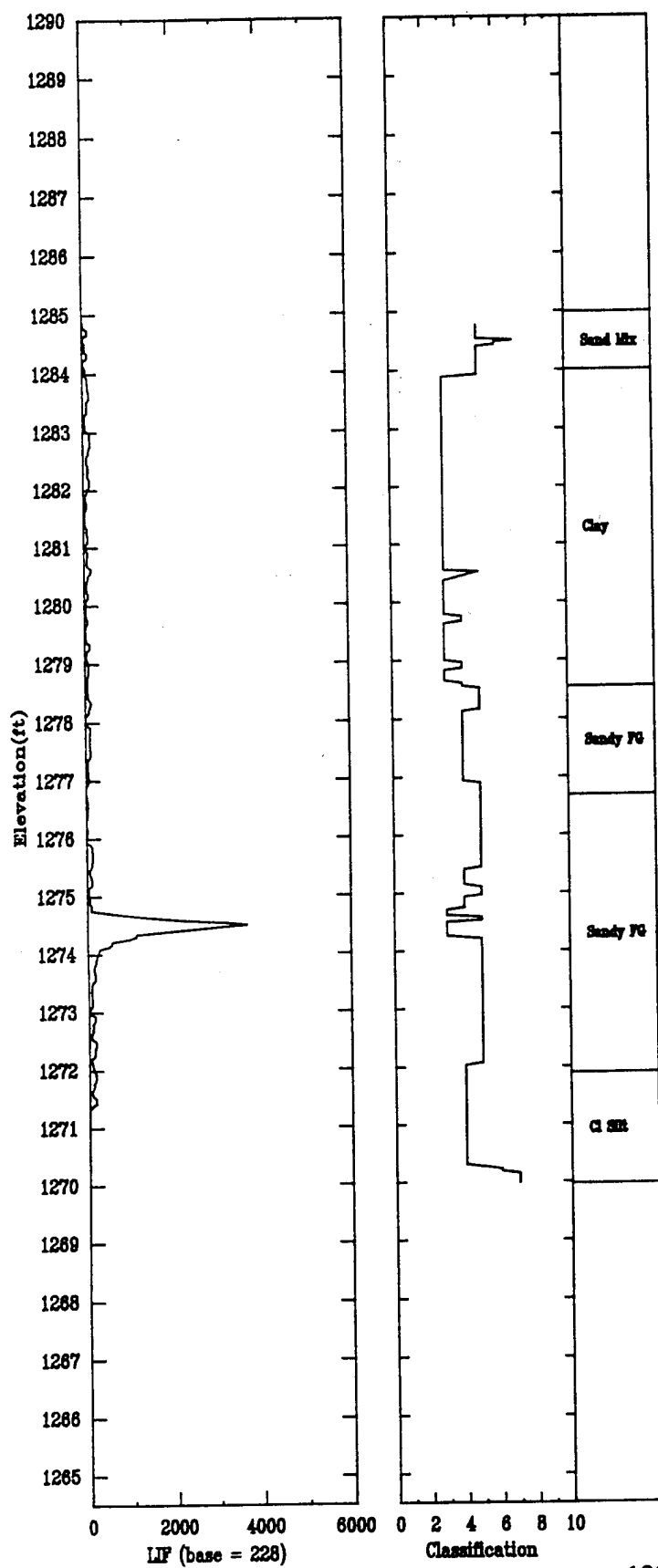
APPLIED RESEARCH ASSOCIATES, INC.

09/21/92

North 149370.

East 2185555.

Elevation 1285.0



FPA-50

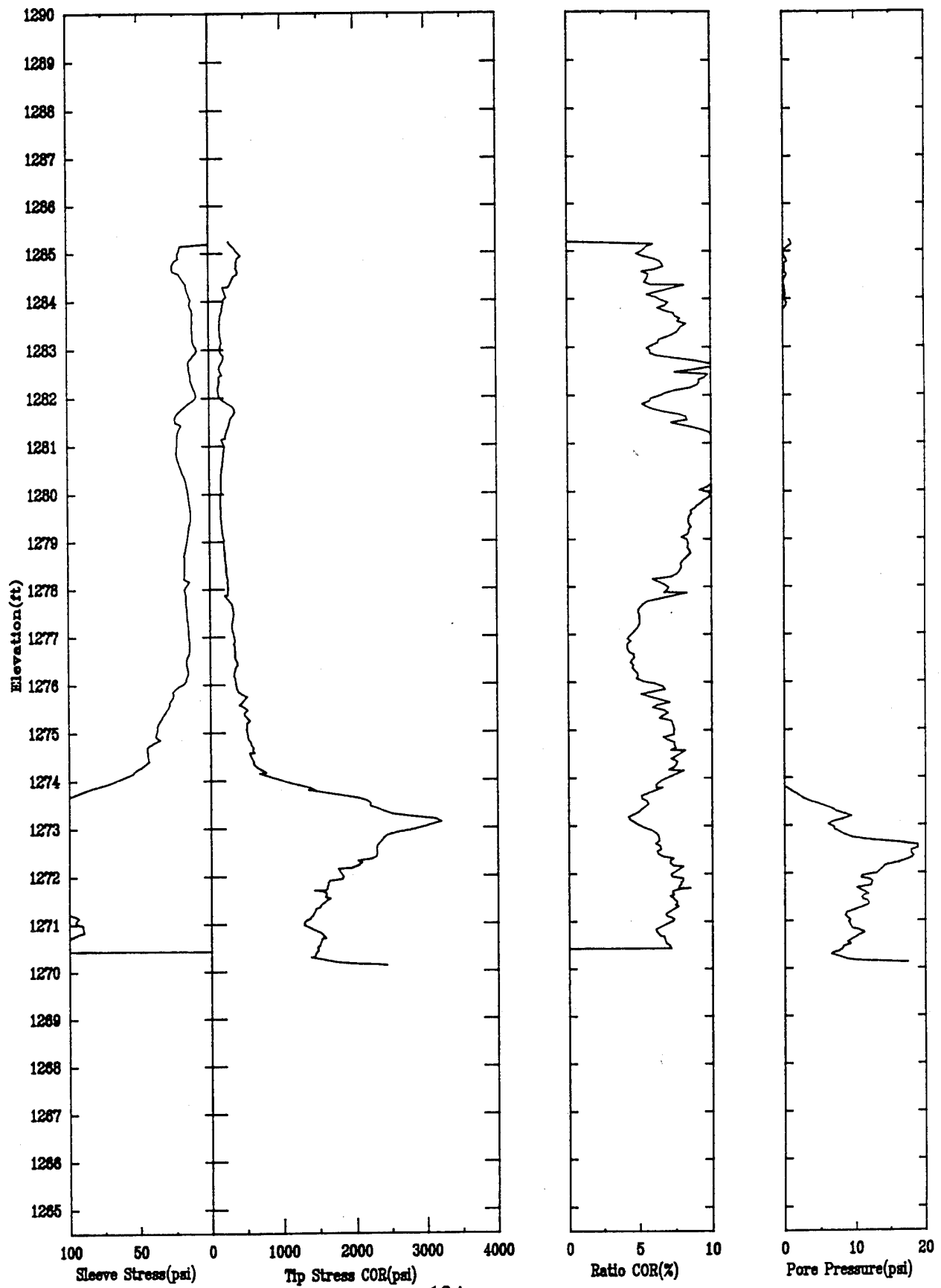
APPLIED RESEARCH ASSOCIATES, INC.

09/21/92

North 149381.

East 2185528.

Elevation 1285.4



FPA-50

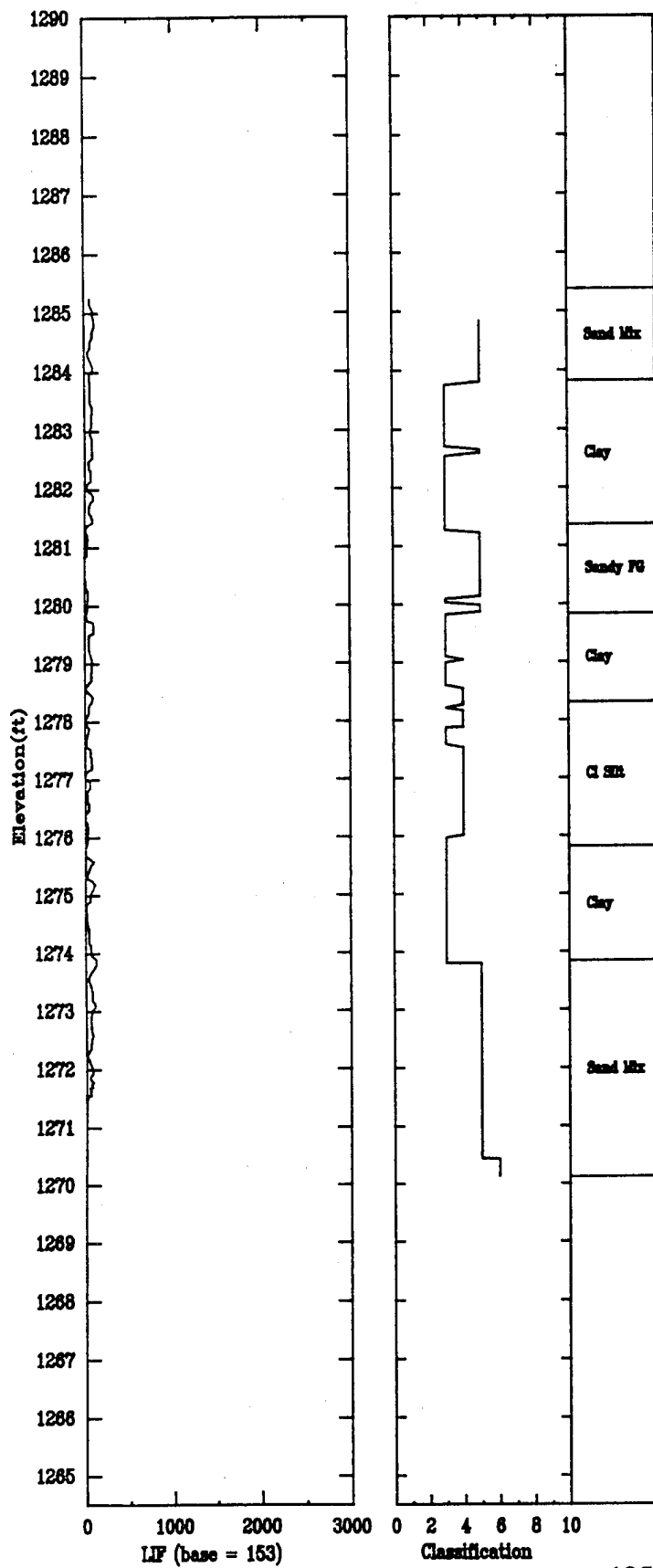
APPLIED RESEARCH ASSOCIATES, INC.

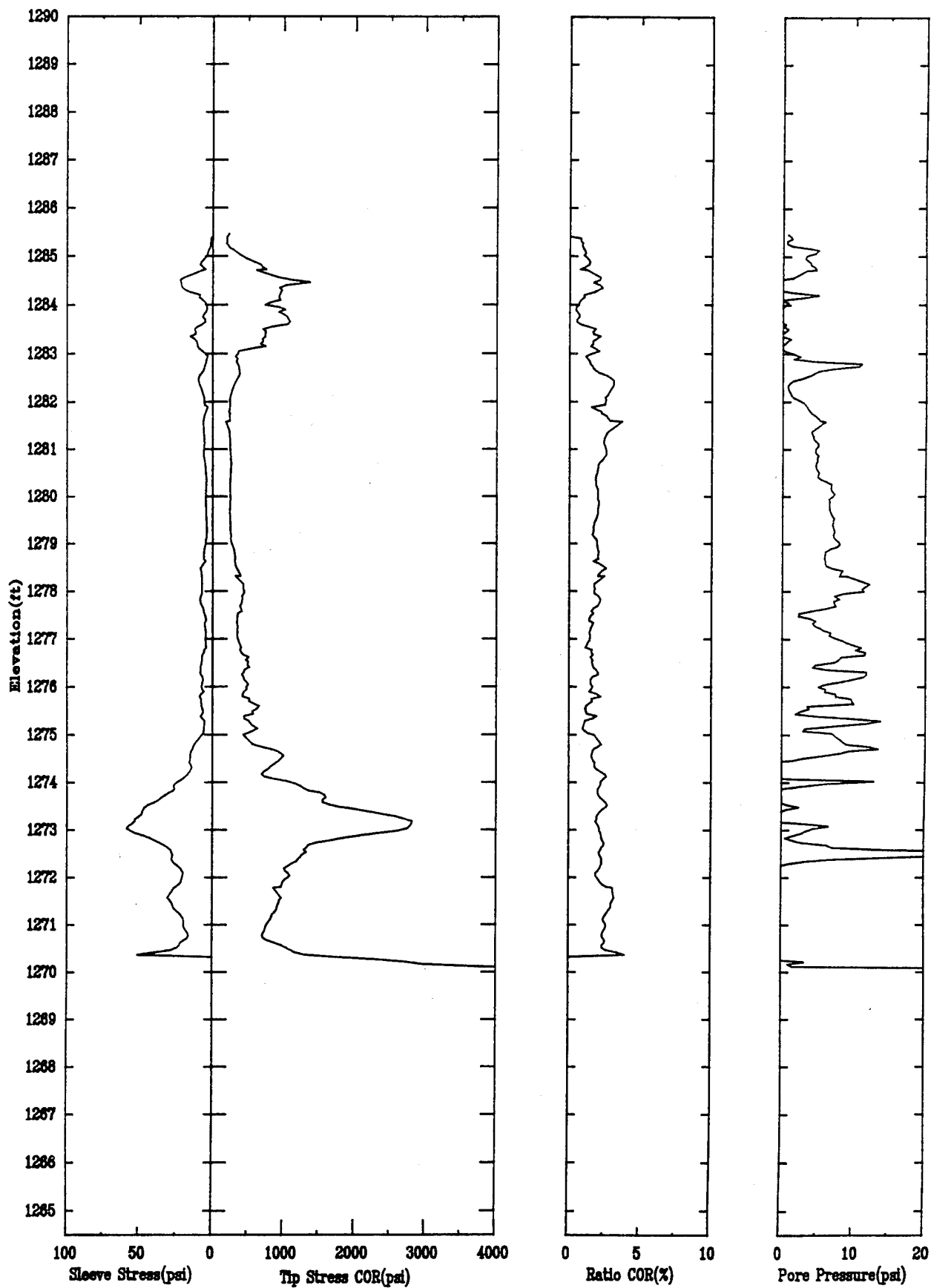
09/21/92

North 149381.

East 2185528.

Elevation 1285.4





FPA-51

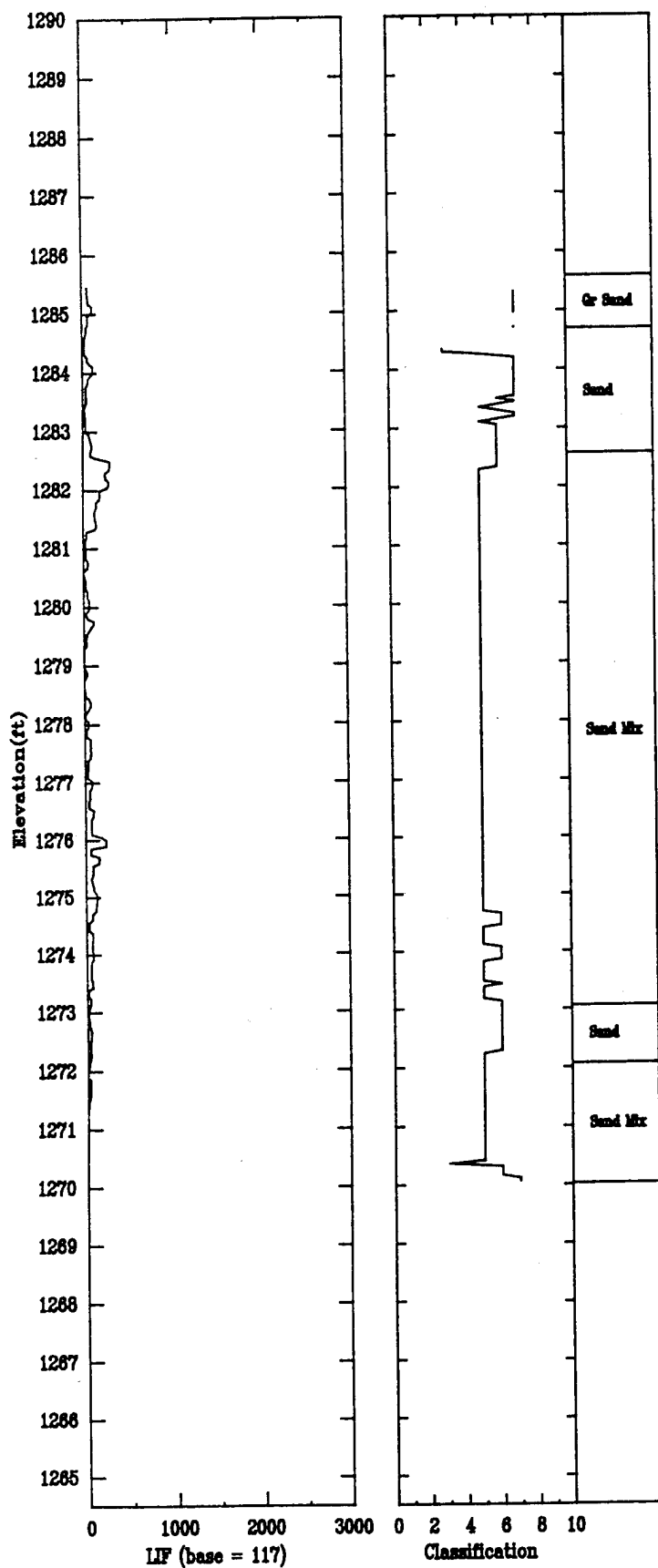
APPLIED RESEARCH ASSOCIATES, INC.

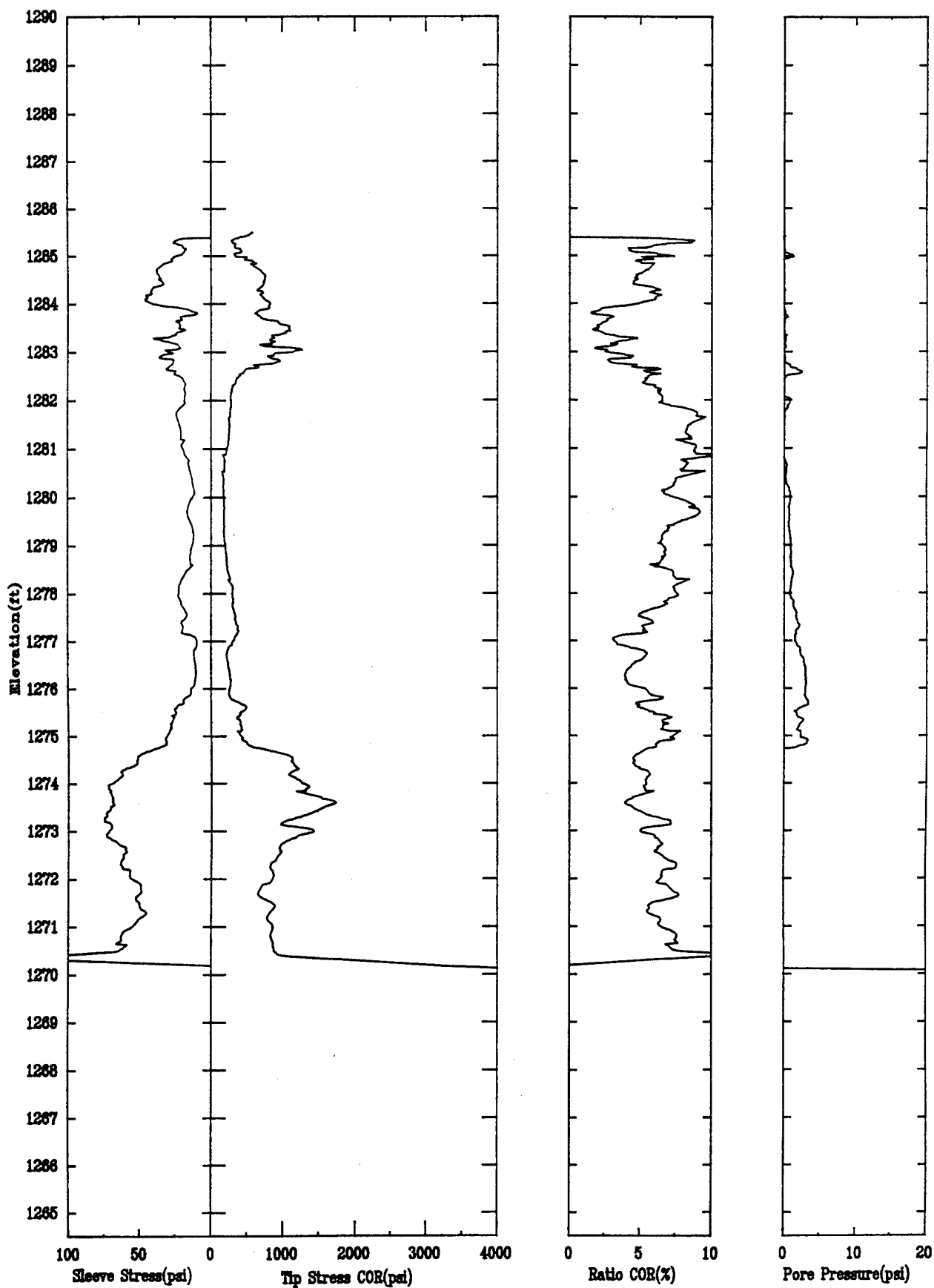
09/25/92

North 149424.

East 2185589.

Elevation 1285.6





FPA-52

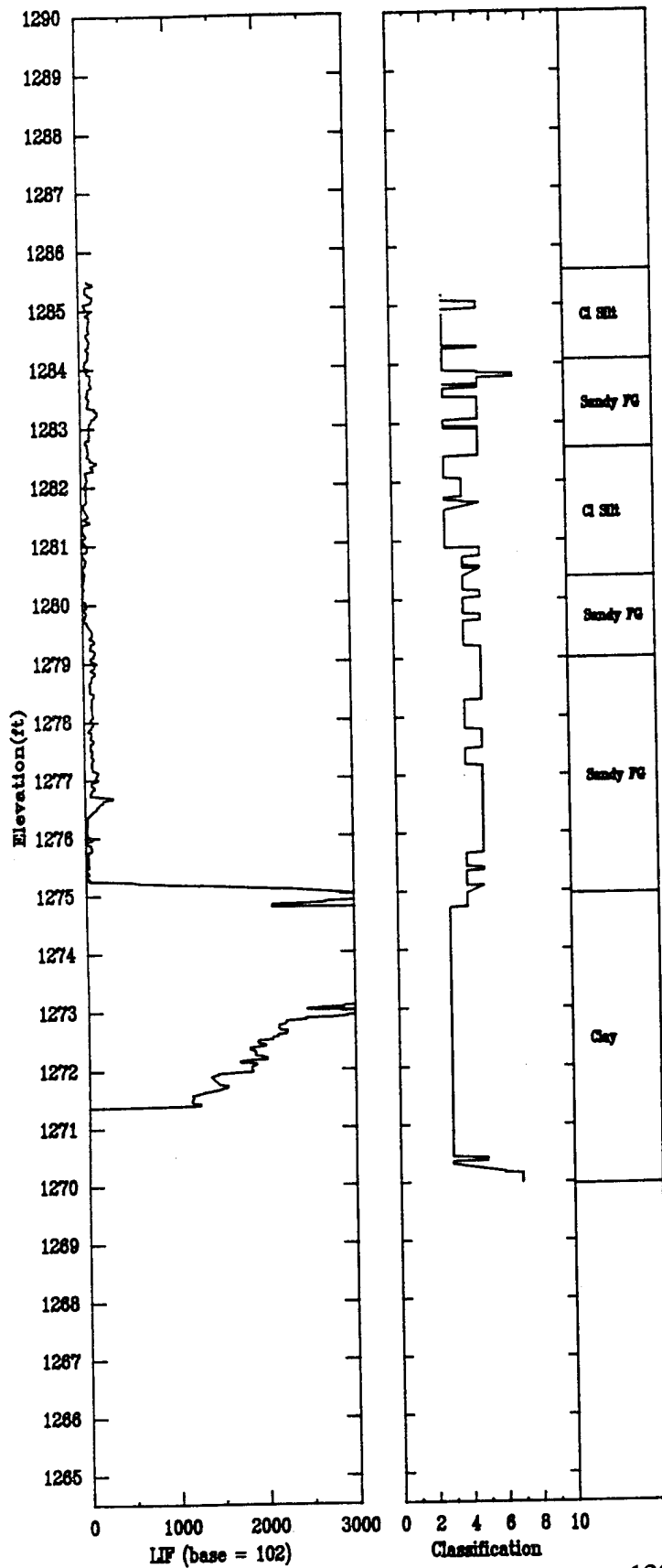
APPLIED RESEARCH ASSOCIATES, INC.

09/25/92

North 149422.

East 2185589.

Elevation 1285.6



FPA-53

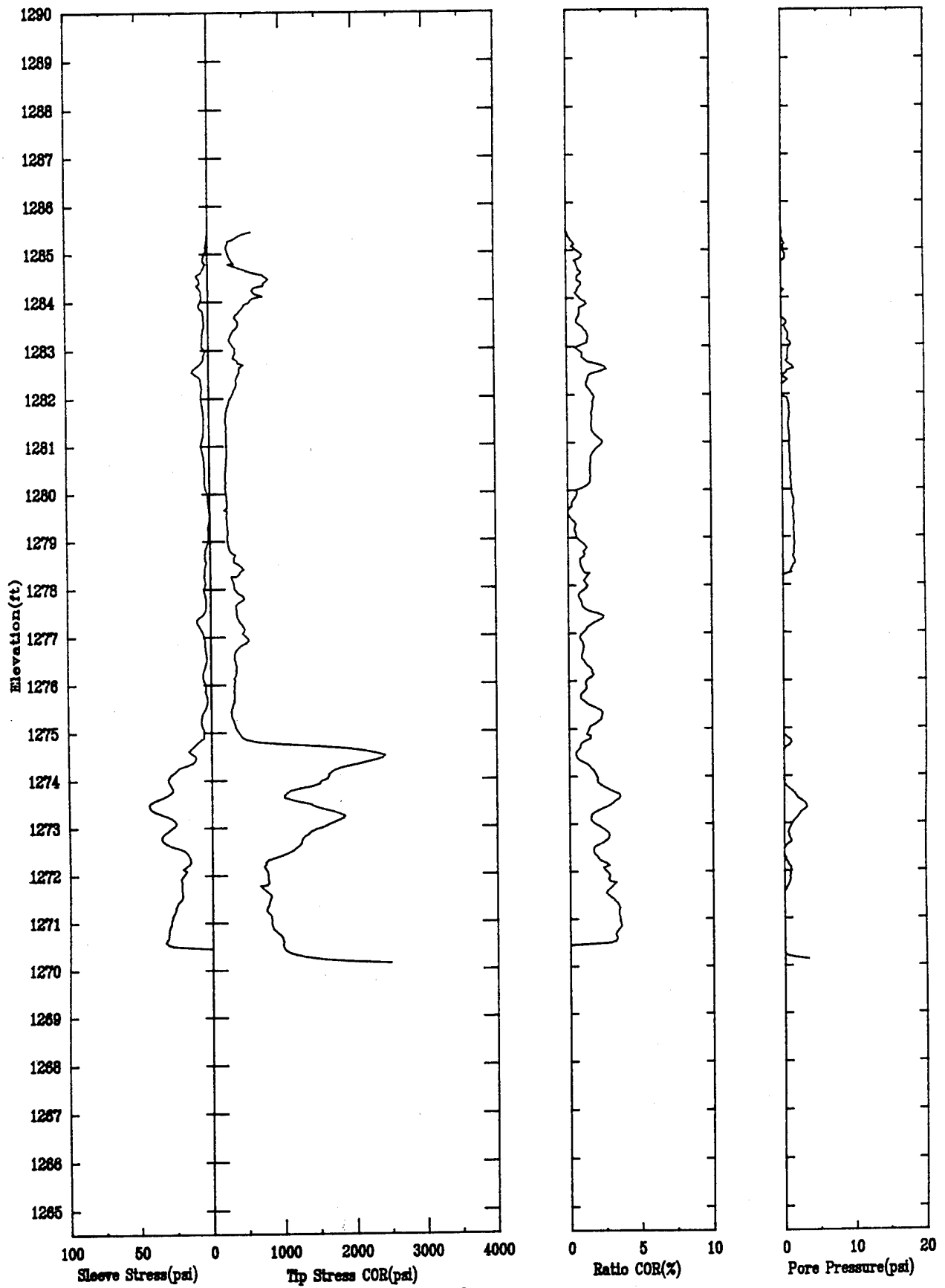
APPLIED RESEARCH ASSOCIATES, INC.

09/25/92

North 149419.

East 2185588.

Elevation 1285.6



FPA-53

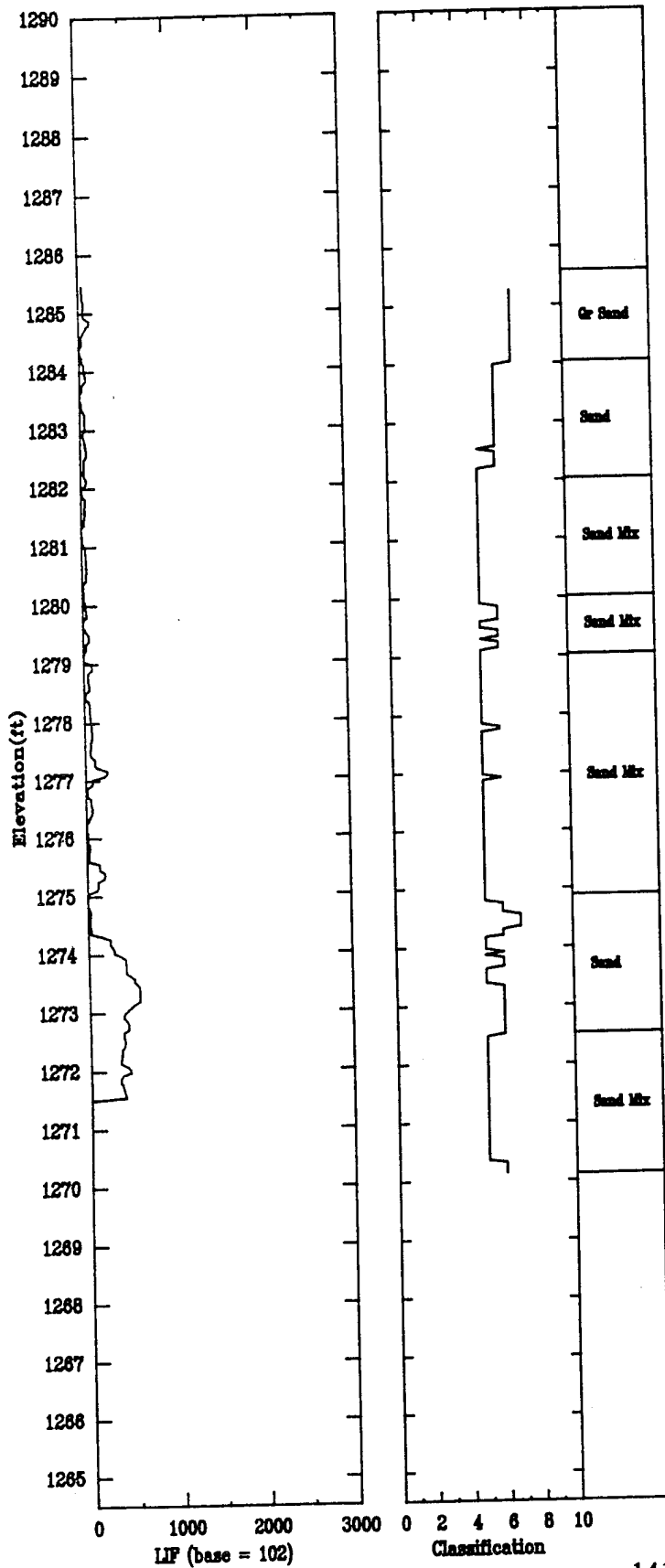
APPLIED RESEARCH ASSOCIATES, INC.

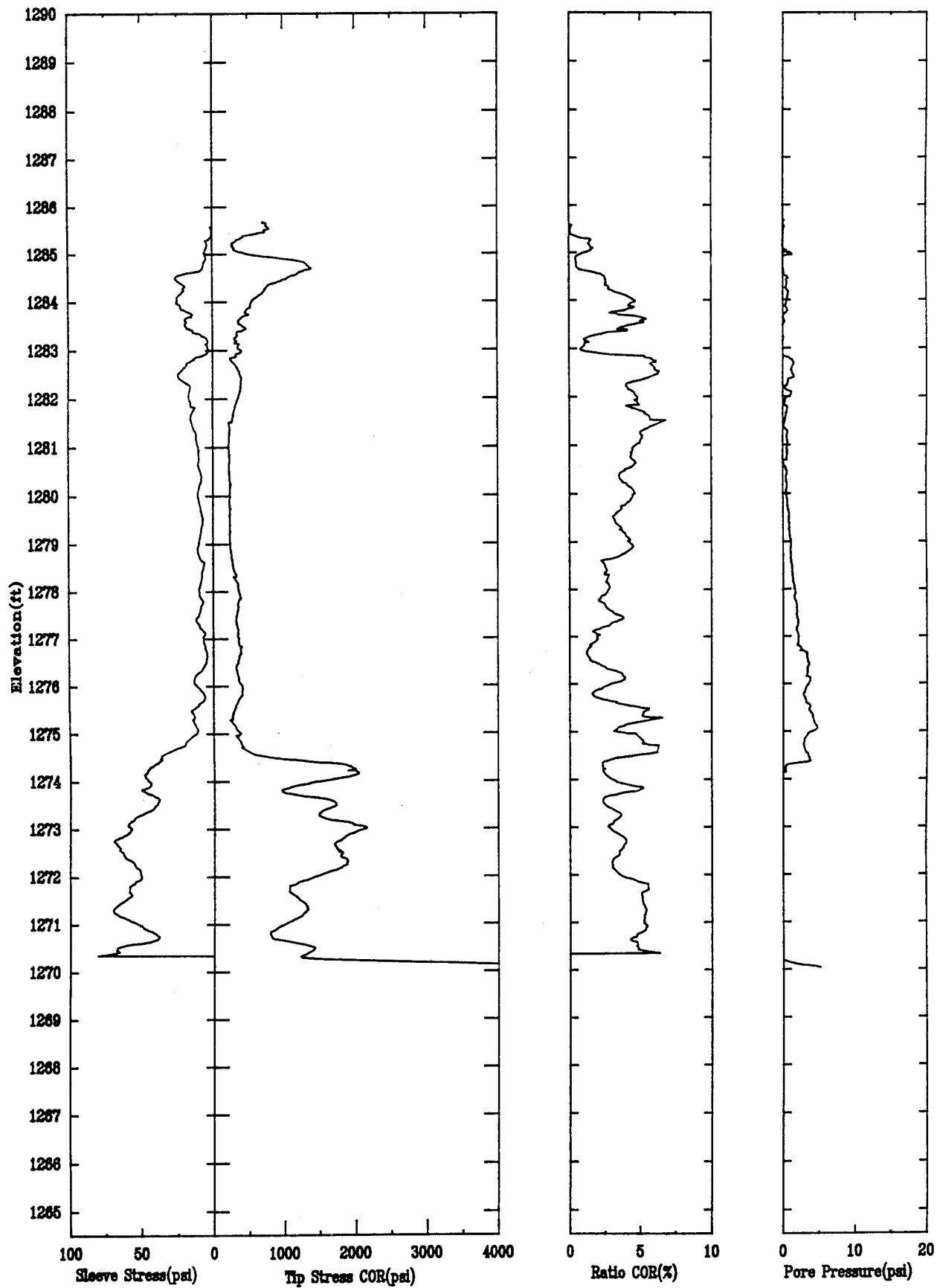
09/25/92

North 149419.

East 2185588.

Elevation 1285.6





FPA-54

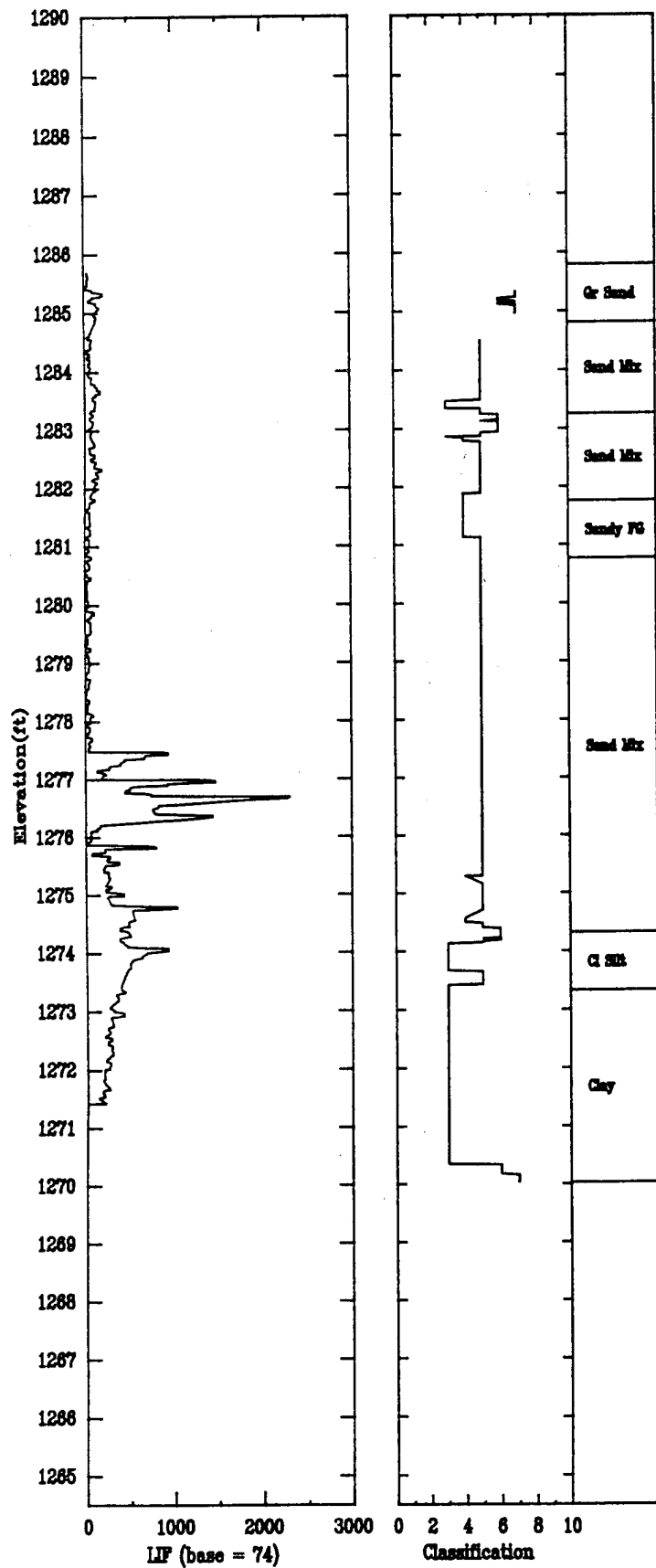
APPLIED RESEARCH ASSOCIATES, INC.

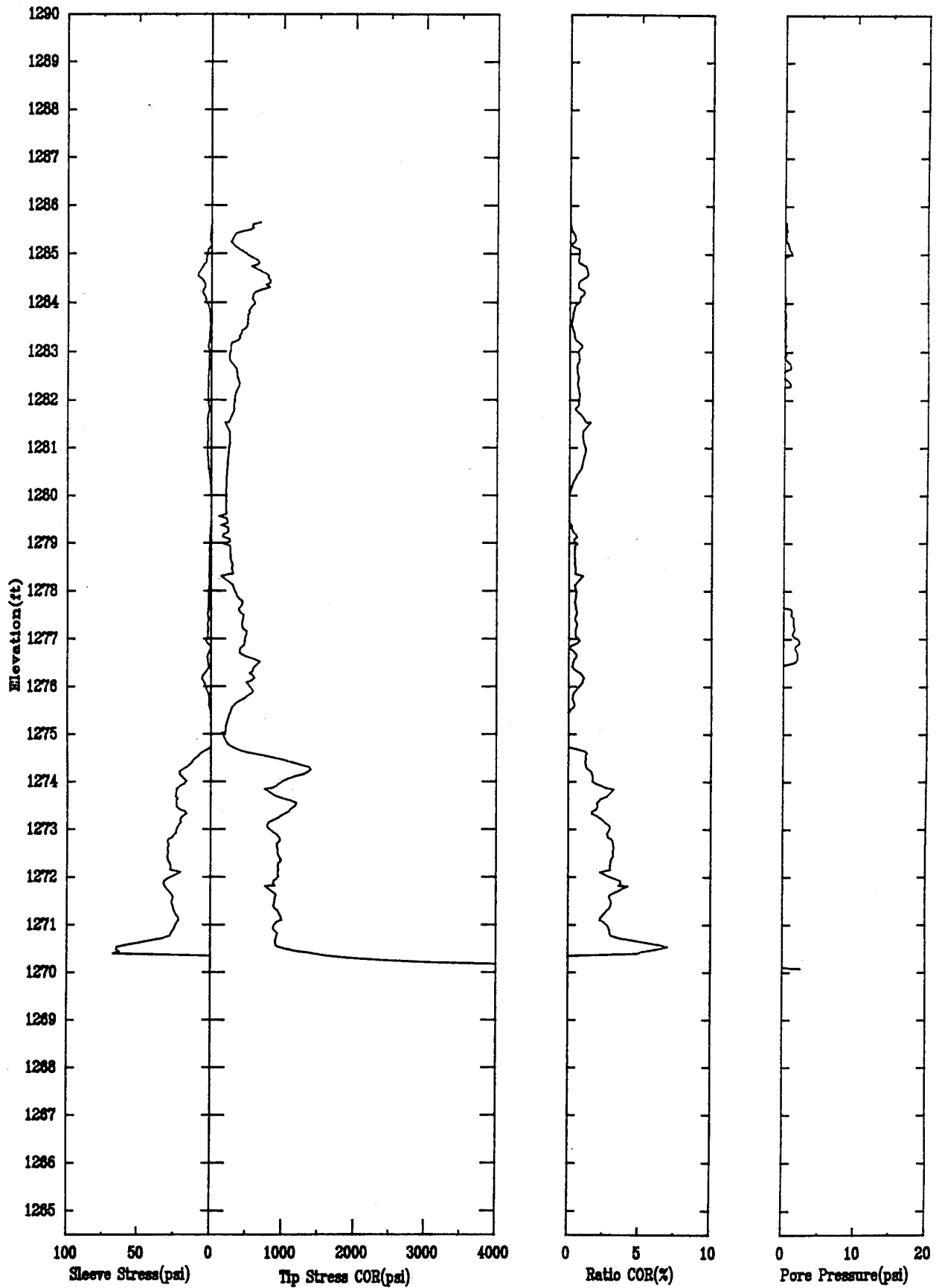
09/25/92

North 149424.

East 2185591.

Elevation 1285.8





FPA-55

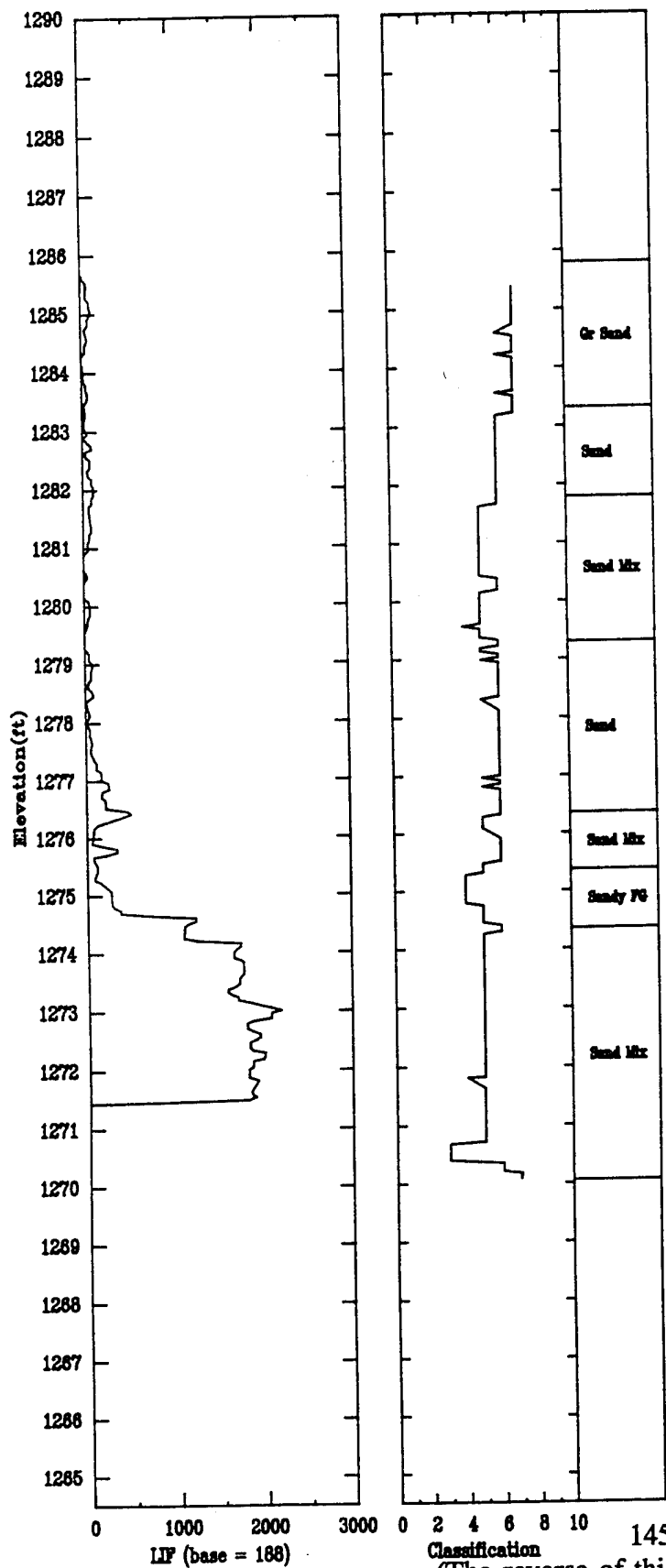
APPLIED RESEARCH ASSOCIATES, INC.

09/25/92

North 149422.

East 2185591.

Elevation 1285.8



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APPENDIX C

LIF-CPT PROFILES FROM FIRE TRAINING AREA

FTA-01

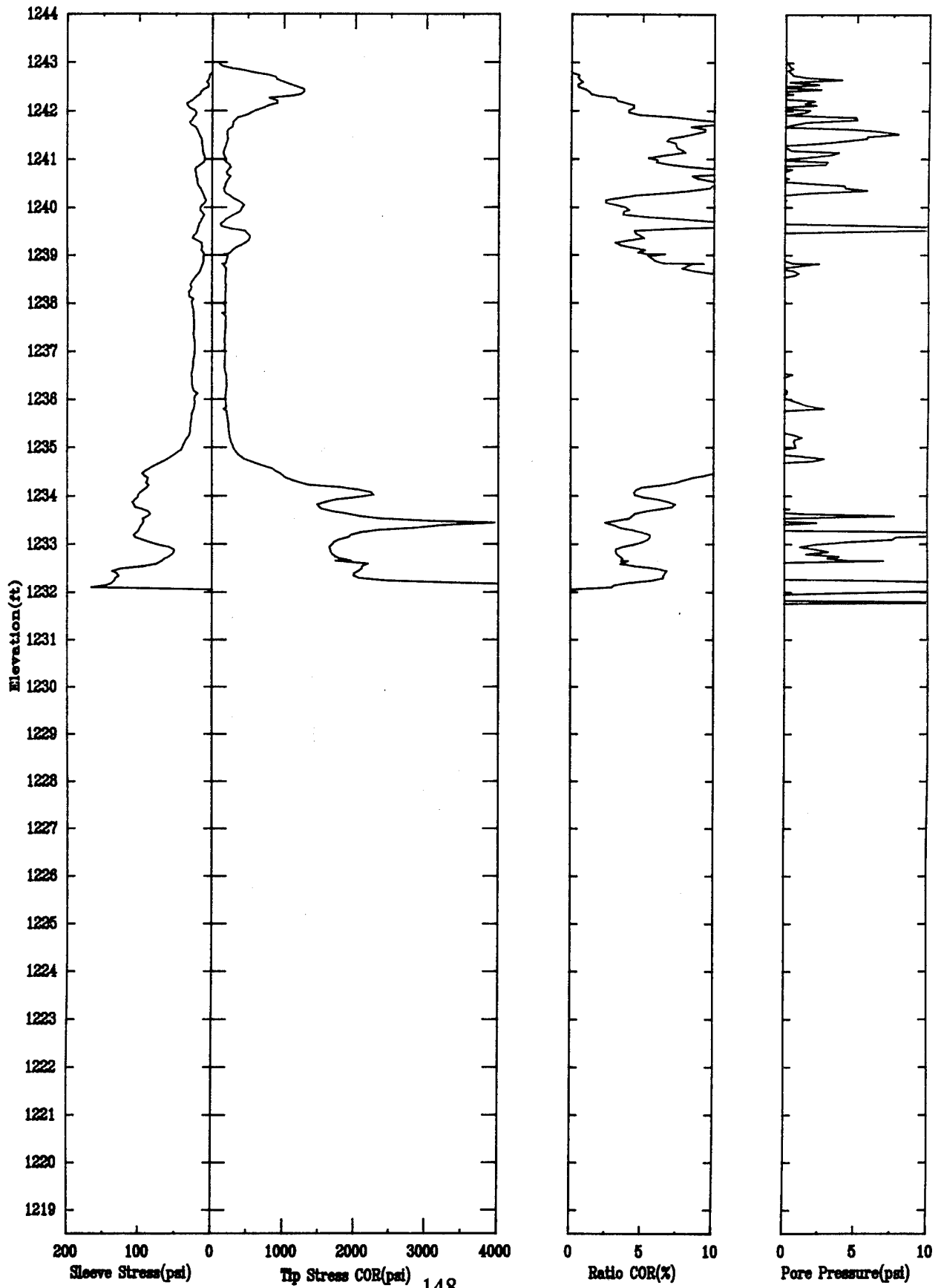
APPLIED RESEARCH ASSOCIATES, INC.

09/24/92

North 150328.

East 2181754.

Elevation 1243.0



FTA-01

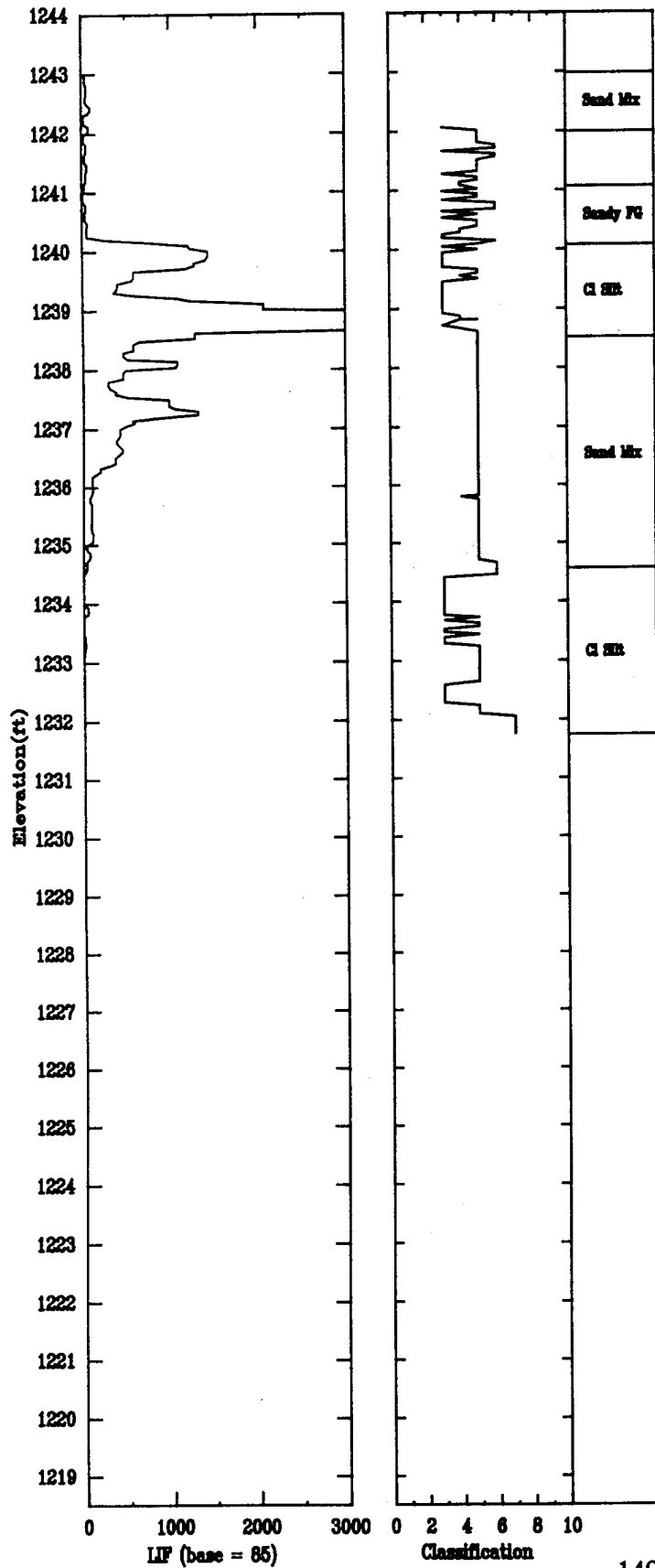
APPLIED RESEARCH ASSOCIATES, INC.

09/24/92

North 150328.

East 2181754.

Elevation 1243.0



FTA-02

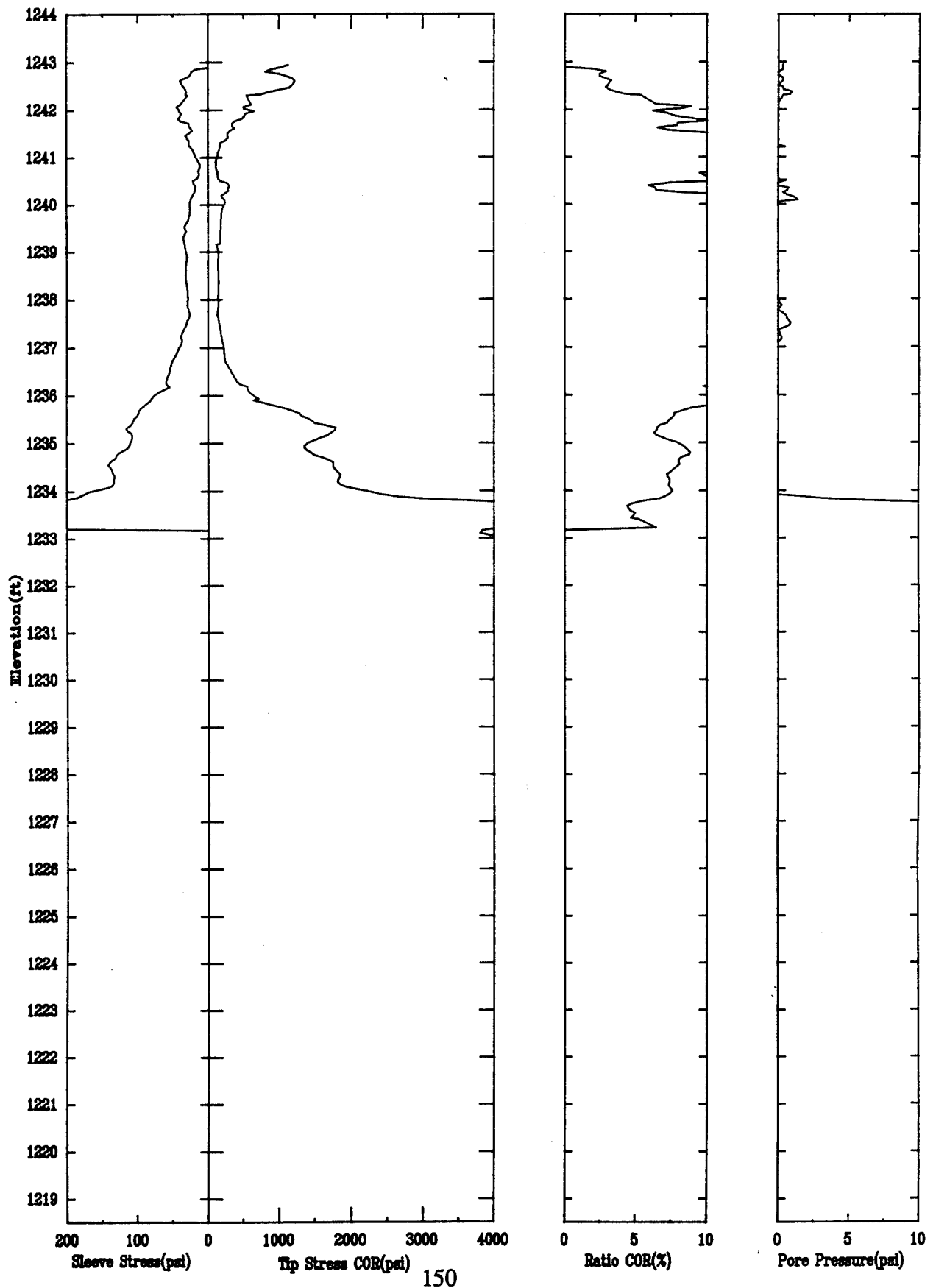
APPLIED RESEARCH ASSOCIATES, INC.

09/24/92

North 150346.

East 2181785.

Elevation 1243.1



FTA-02

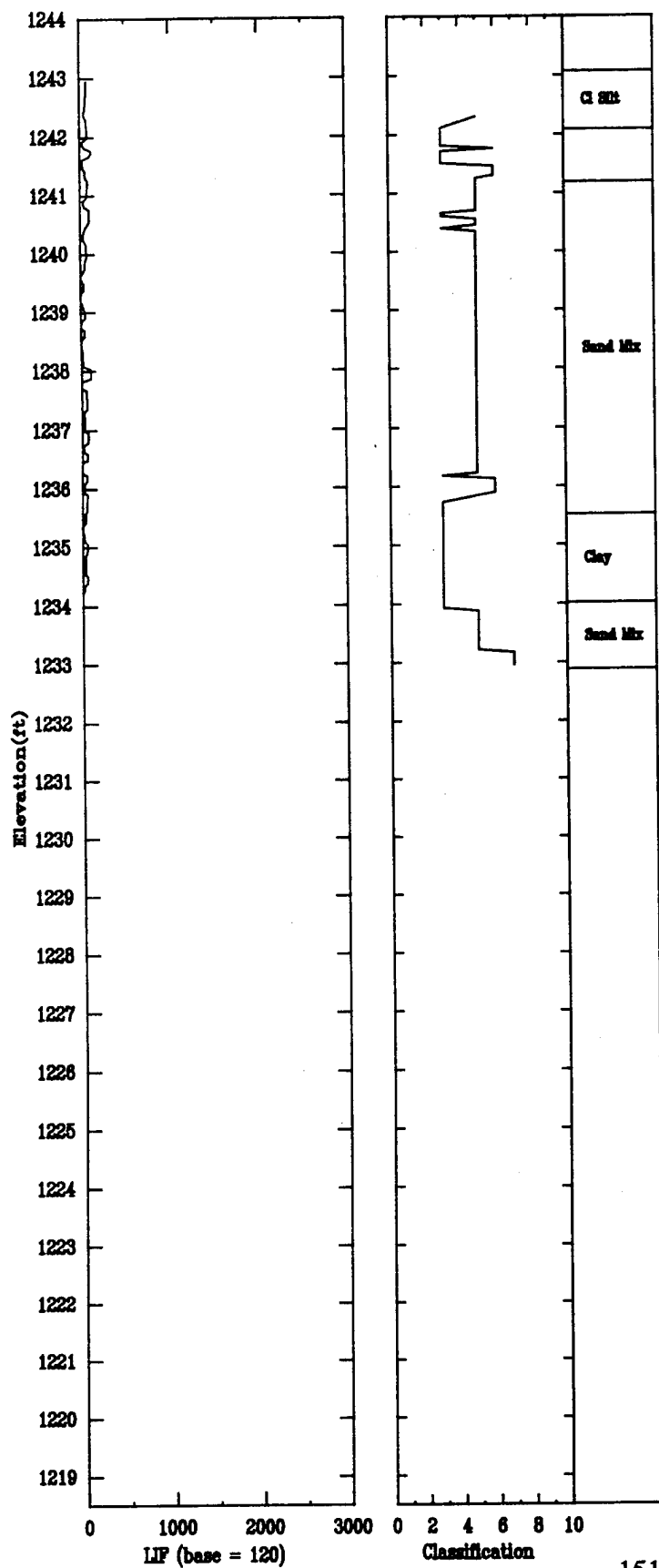
APPLIED RESEARCH ASSOCIATES, INC.

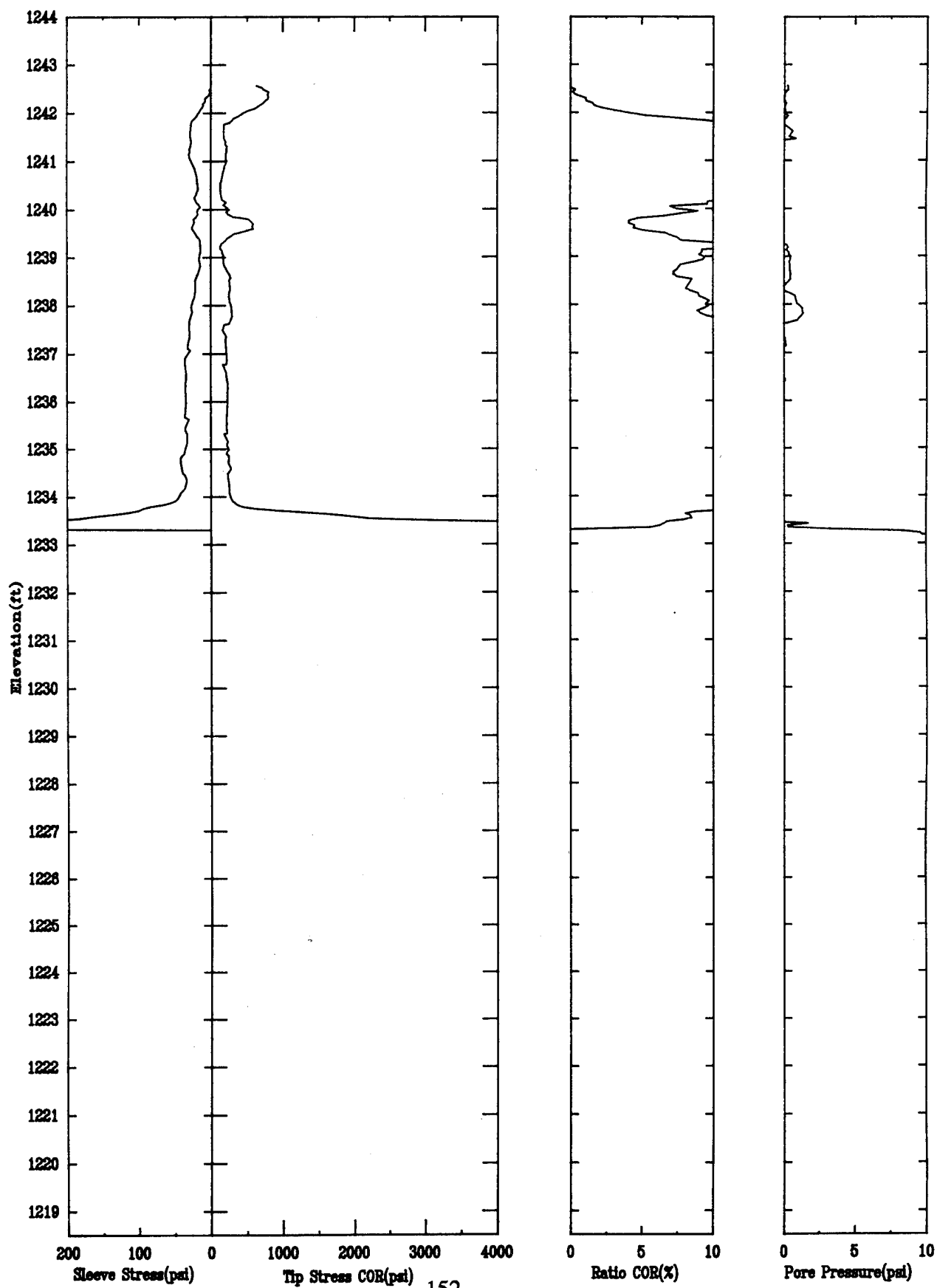
09/24/92

North 150346.

East 2181785.

Elevation 1243.1





FTA-03

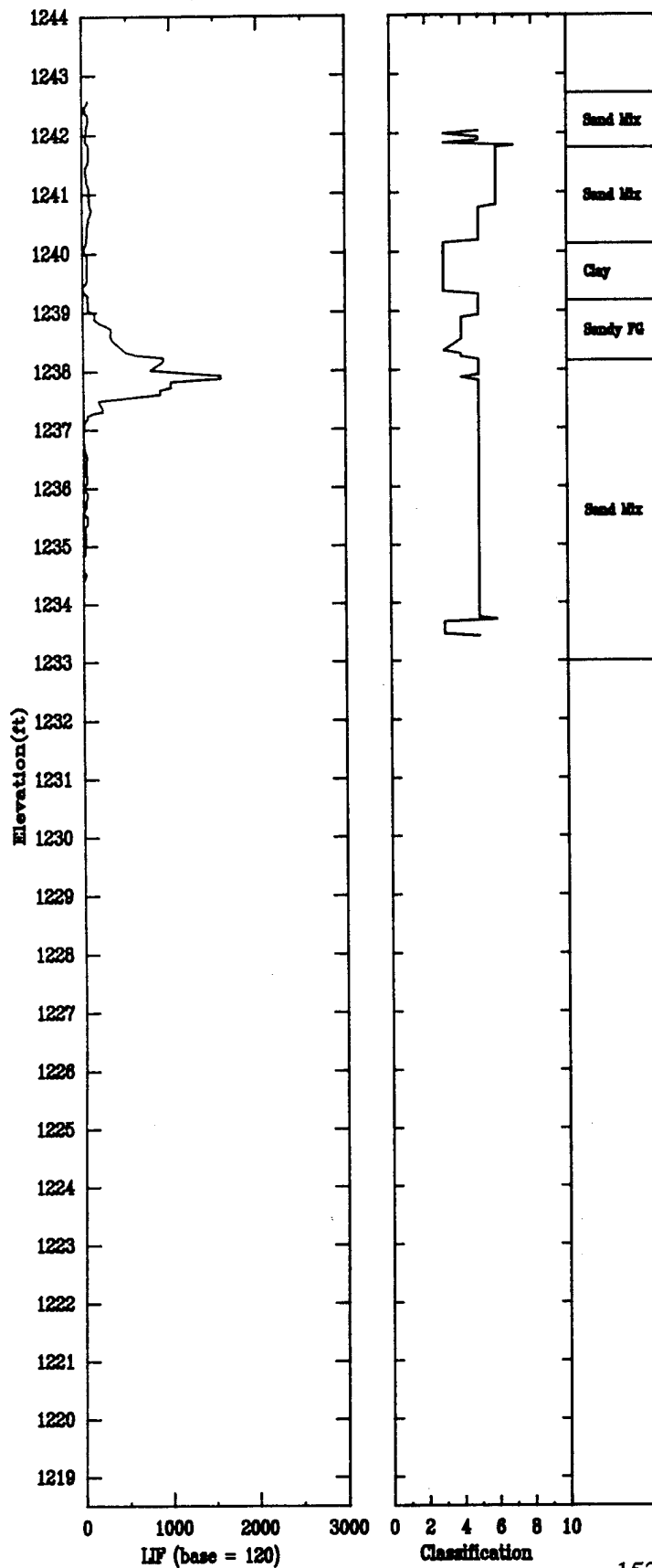
APPLIED RESEARCH ASSOCIATES, INC.

09/24/92

North 150334.

East 2181714.

Elevation 1242.7



FTA-04

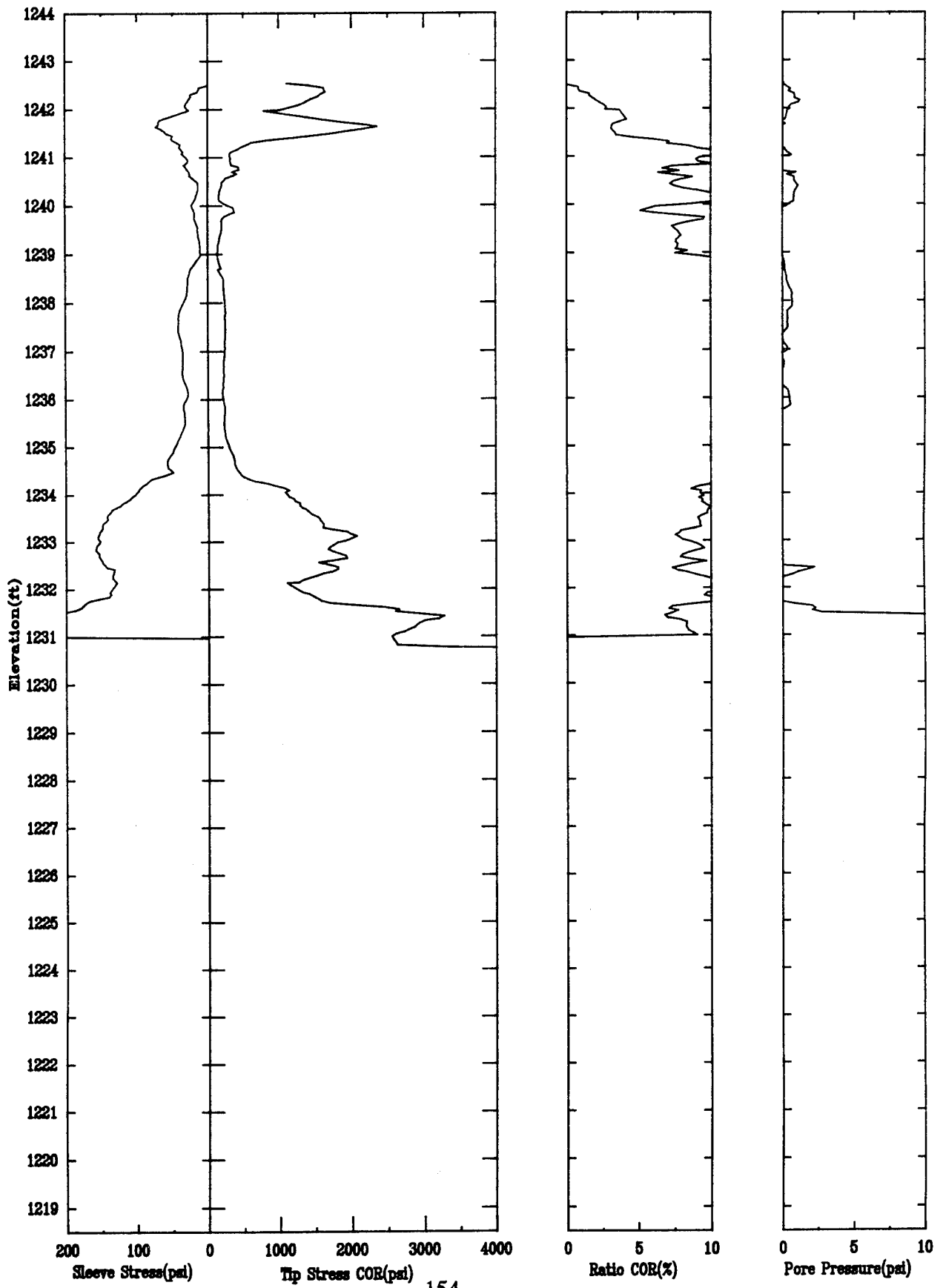
APPLIED RESEARCH ASSOCIATES, INC.

09/24/92

North 150379.

East 2181689.

Elevation 1242.7



FTA-04

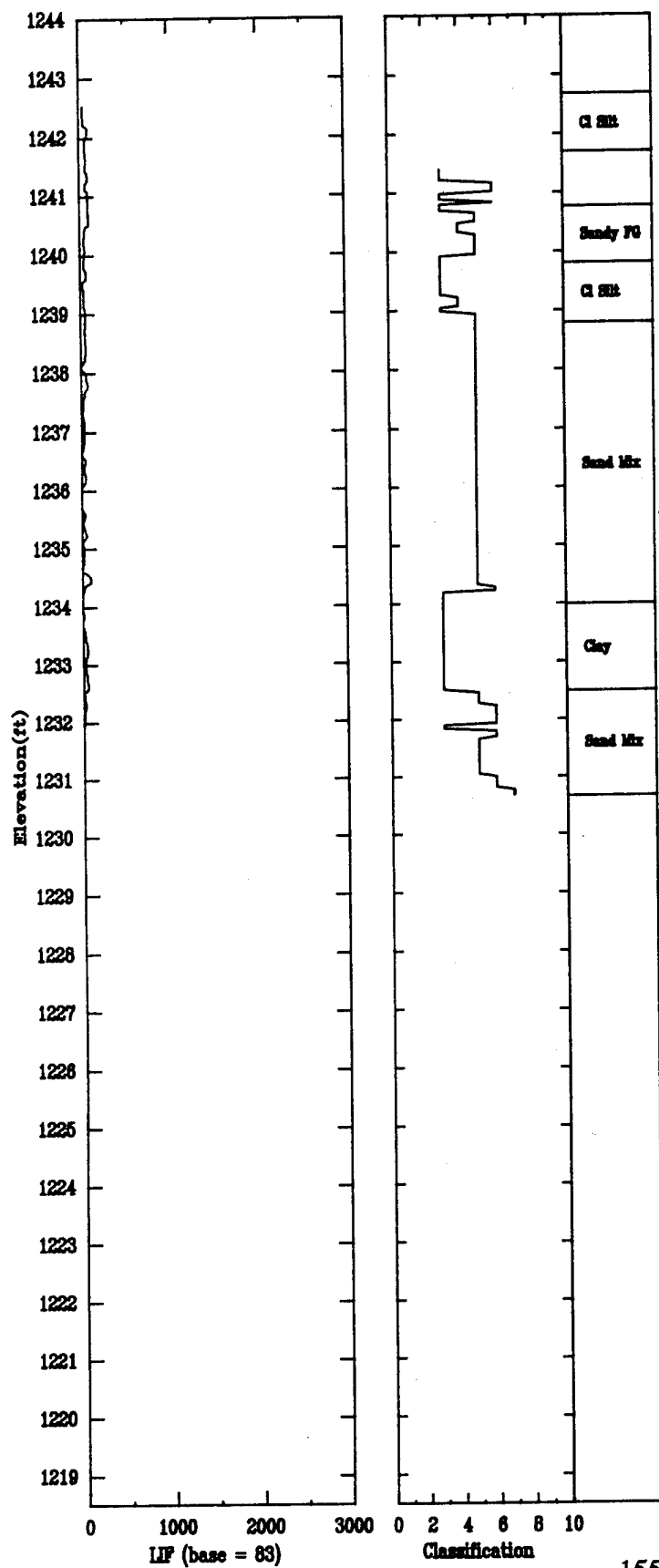
APPLIED RESEARCH ASSOCIATES, INC.

09/24/92

North 150379.

East 2181689.

Elevation 1242.7



FTA-05

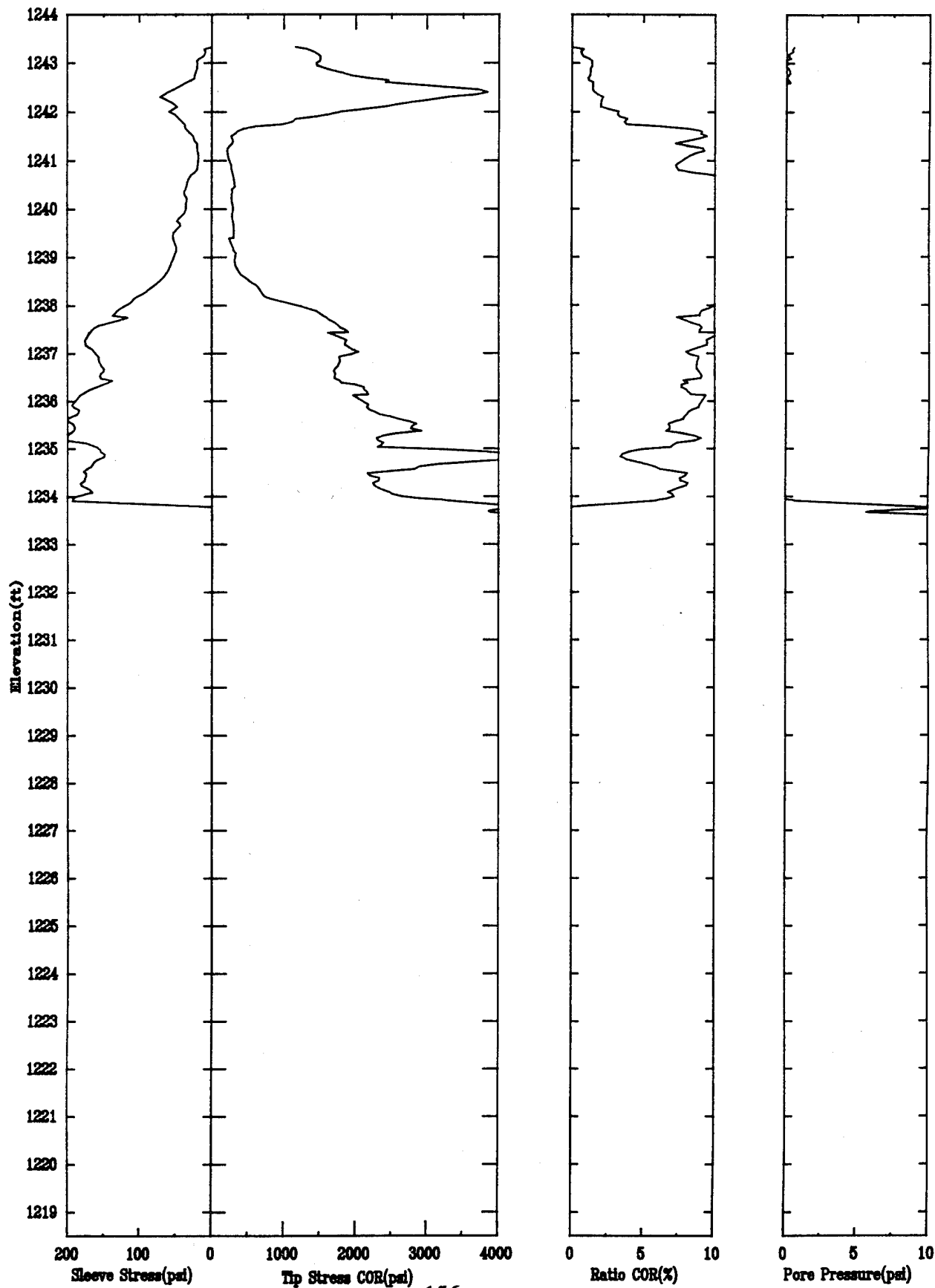
APPLIED RESEARCH ASSOCIATES, INC.

09/24/92

North 150419.

East 2181779.

Elevation 1243.5



FTA-05

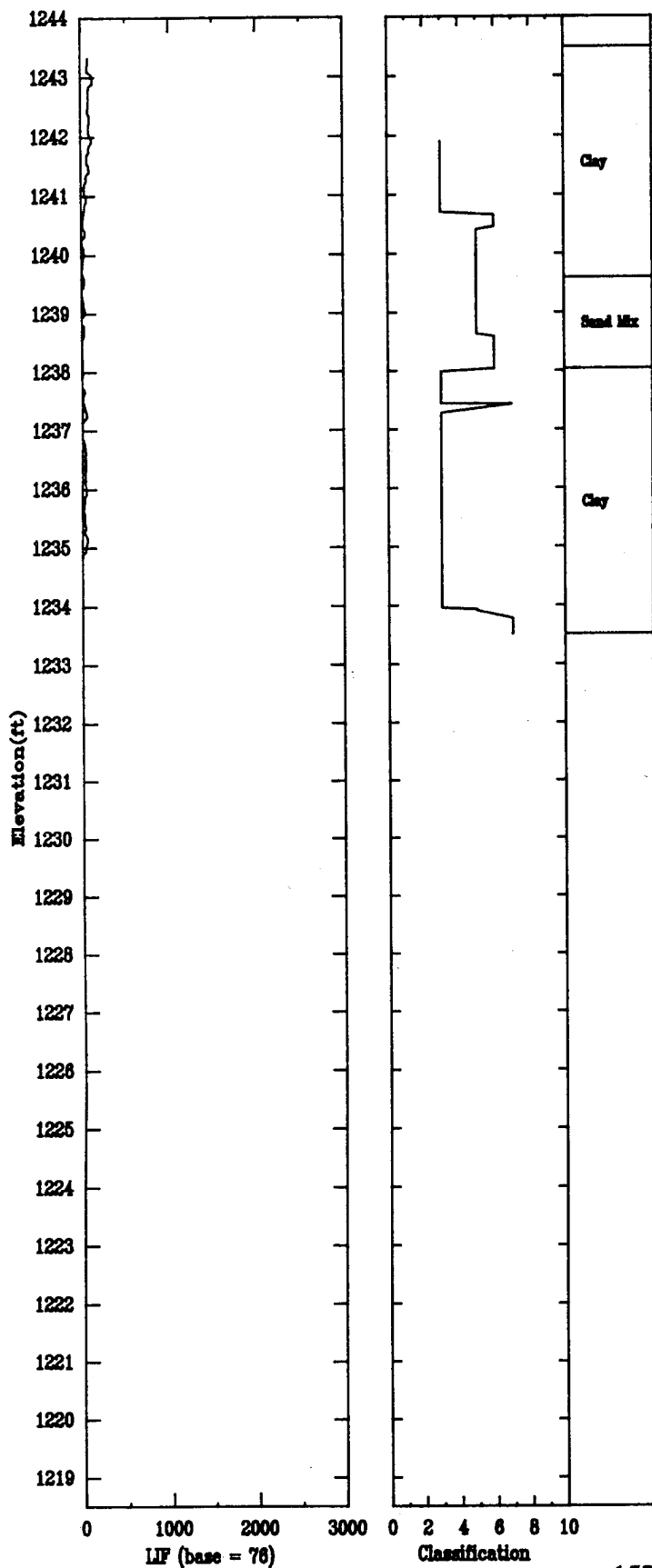
APPLIED RESEARCH ASSOCIATES, INC.

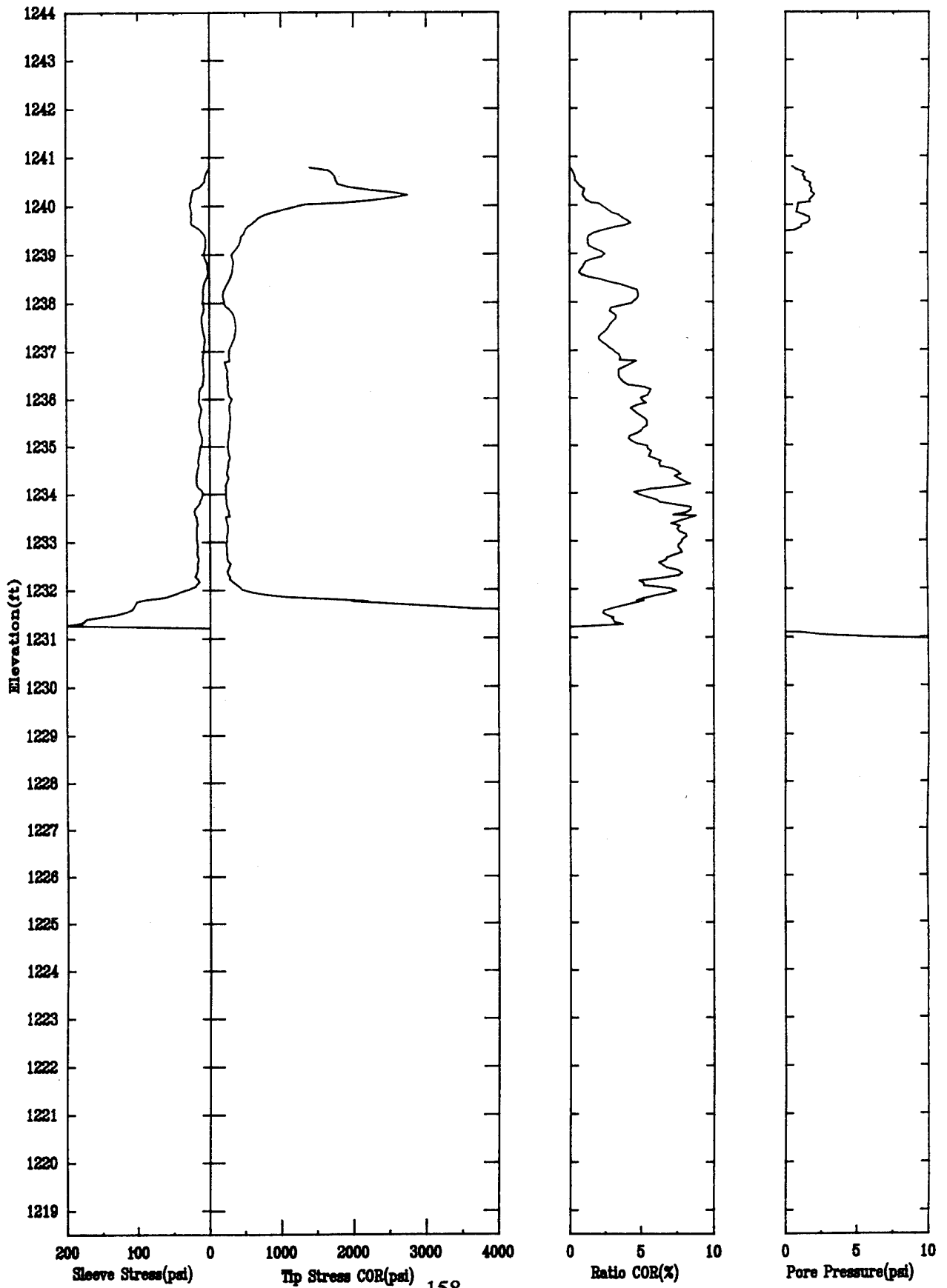
09/24/92

North 150419.

East 2181779.

Elevation 1243.5





FTA-06

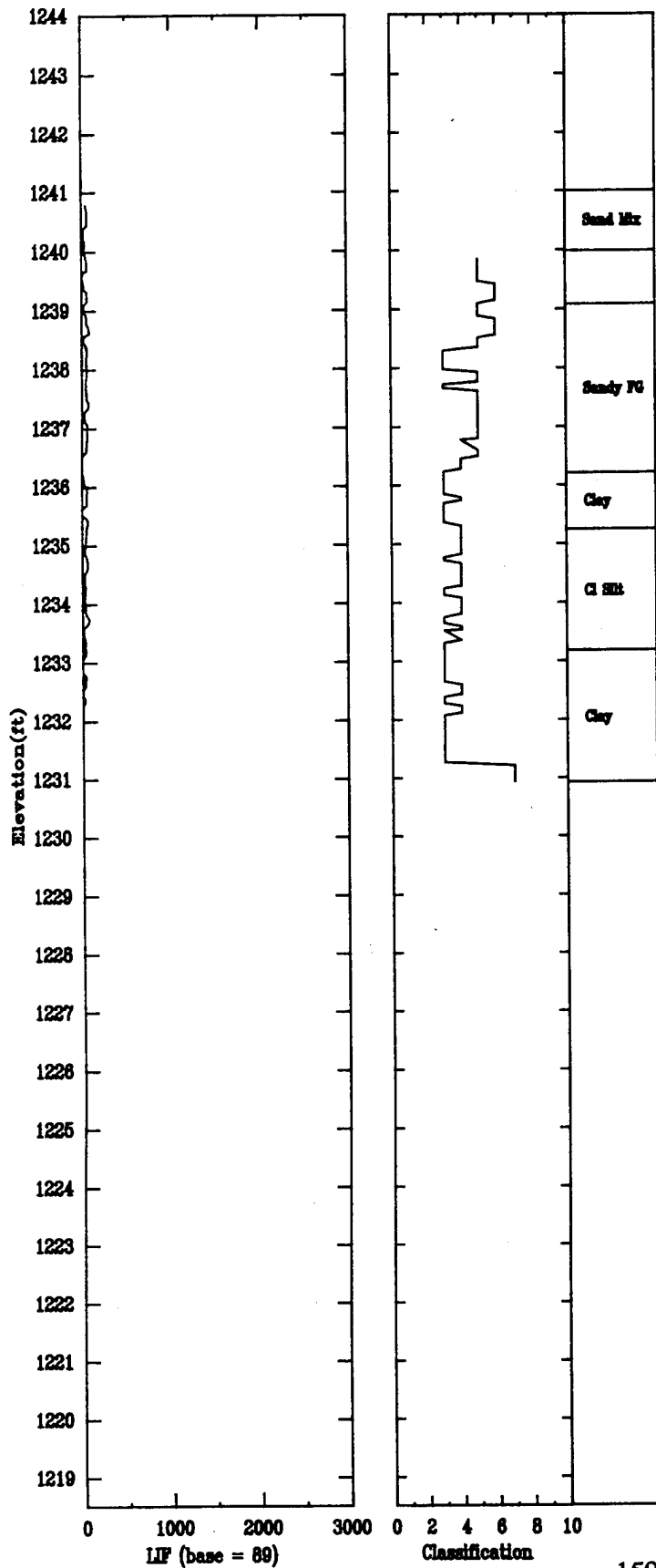
APPLIED RESEARCH ASSOCIATES, INC.

09/24/92

North 150261.

East 2181807.

Elevation 1241.0



FTA-07

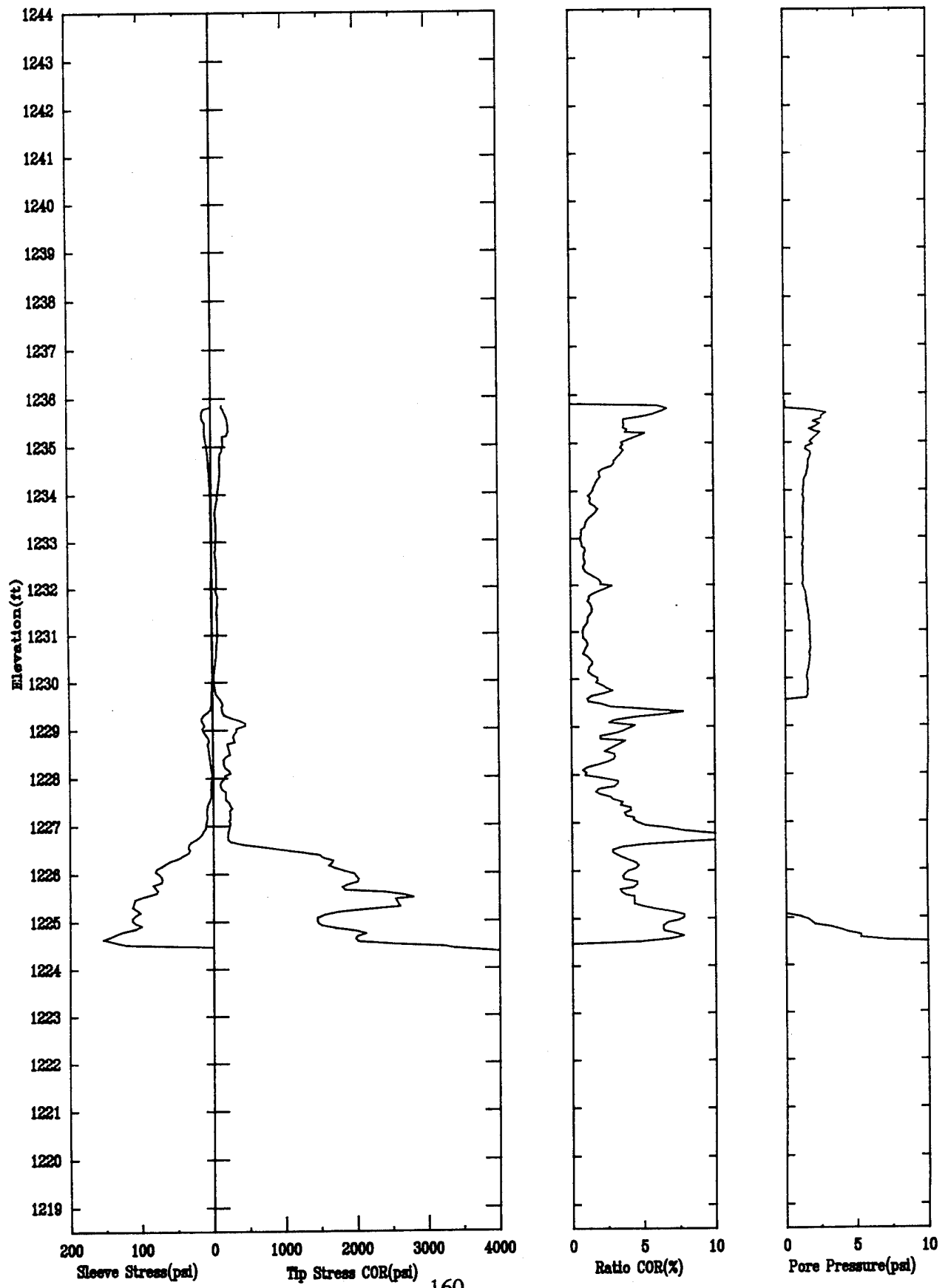
APPLIED RESEARCH ASSOCIATES, INC.

09/24/92

North 150161.

East 2181807.

Elevation 1236.0



FTA-07

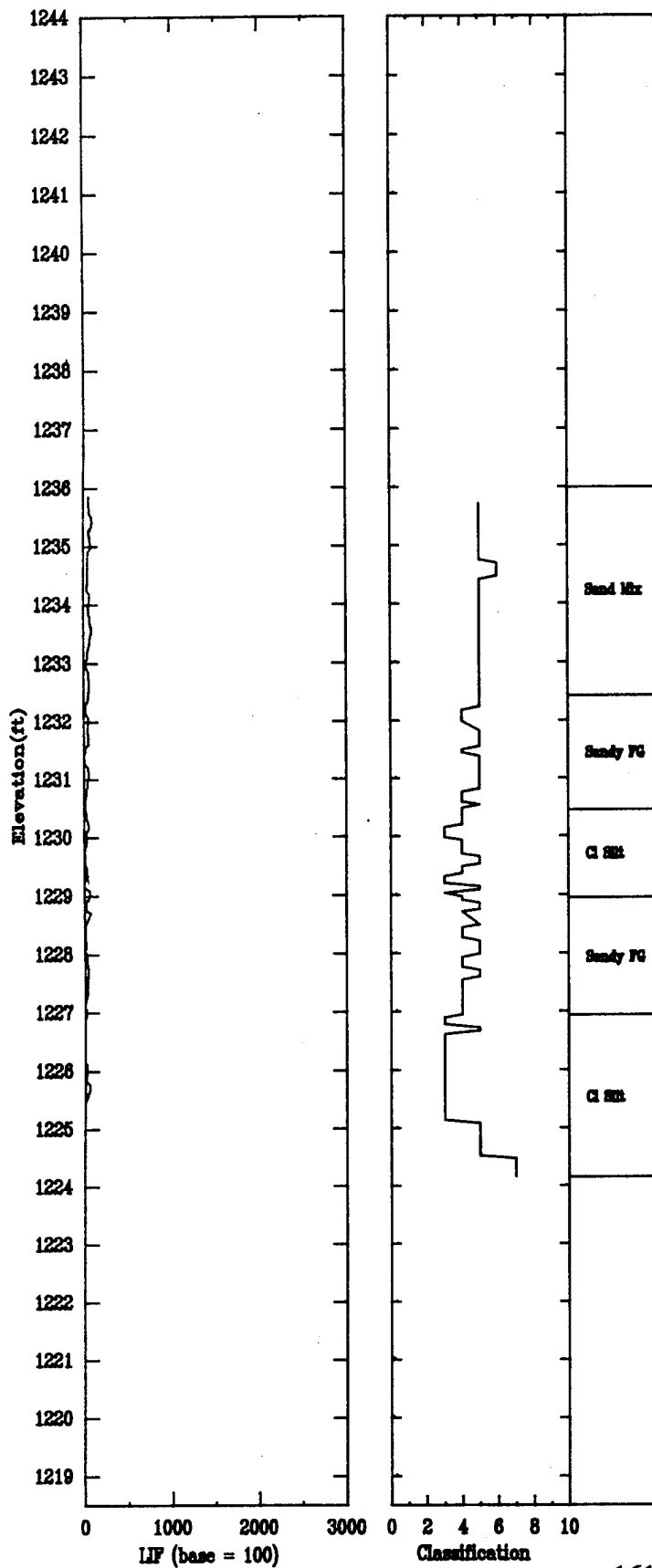
APPLIED RESEARCH ASSOCIATES, INC.

09/24/92

North 150161.

East 2181807.

Elevation 1236.0



FTA-08

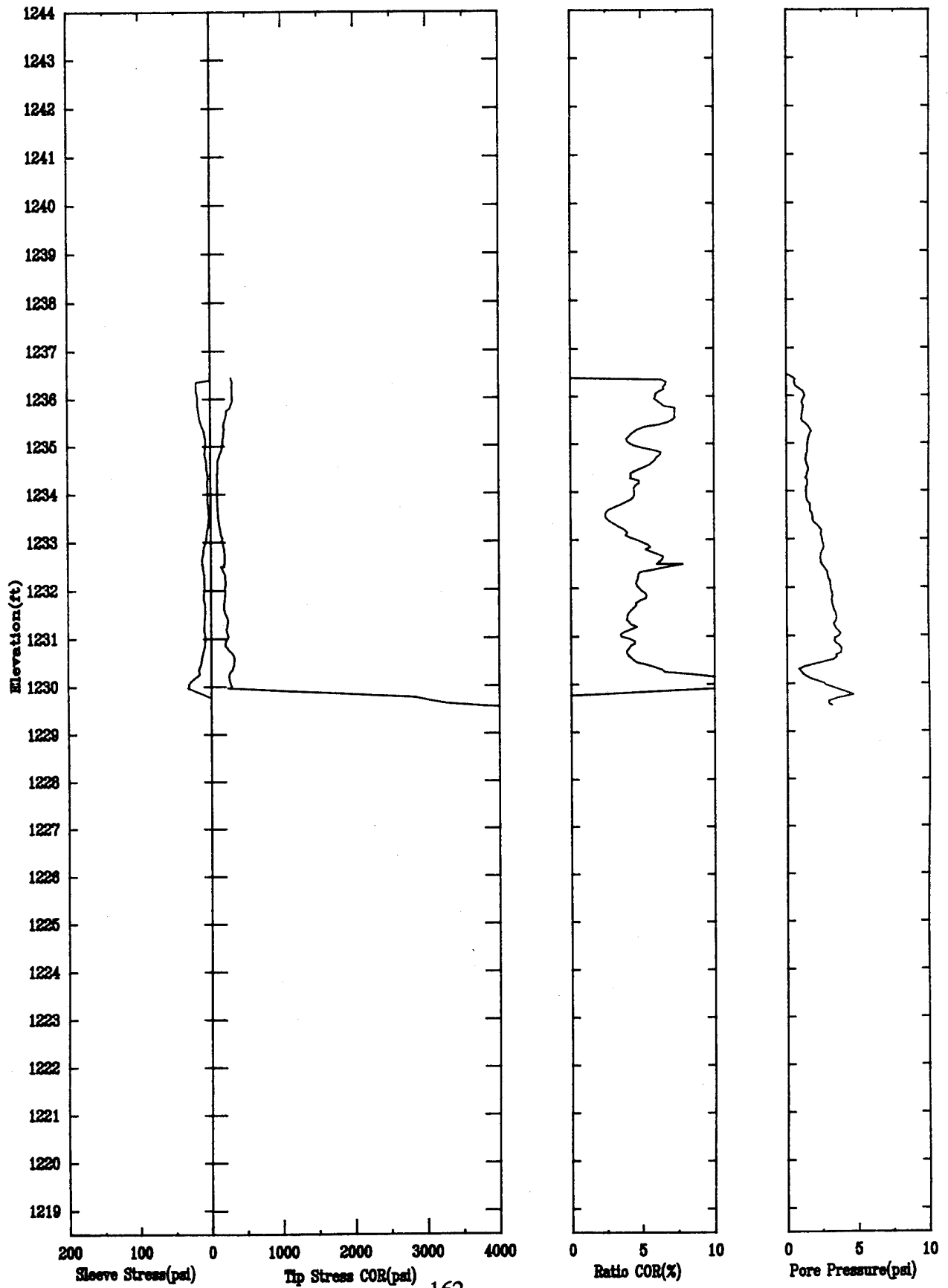
APPLIED RESEARCH ASSOCIATES, INC.

09/24/92

North 150167.

East 2181845.

Elevation 1236.6



FTA-08

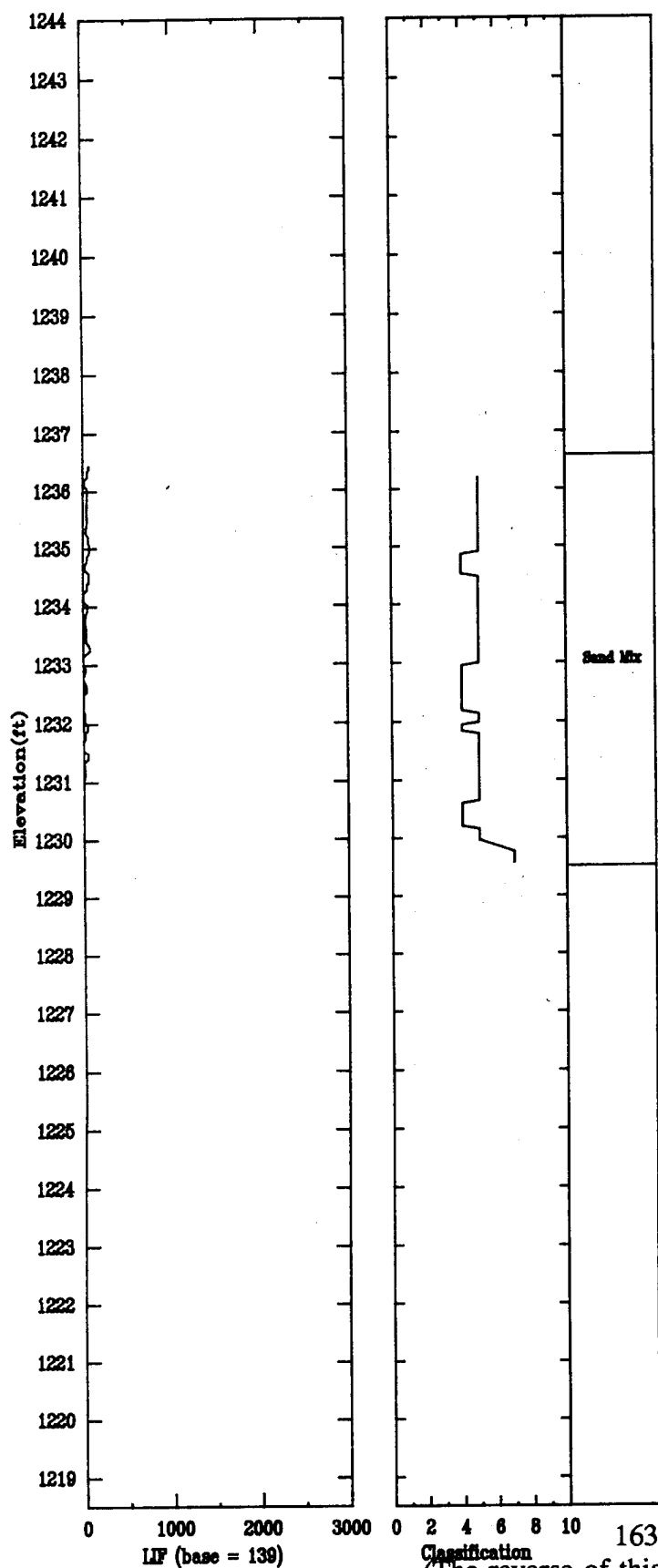
APPLIED RESEARCH ASSOCIATES, INC.

09/24/92

North 150167.

East 2181845.

Elevation 1236.6



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APPENDIX D

LIF-CPT PROFILES FROM THE EAST BANK OF EAST SOLDIER CREEK

OSC-2A

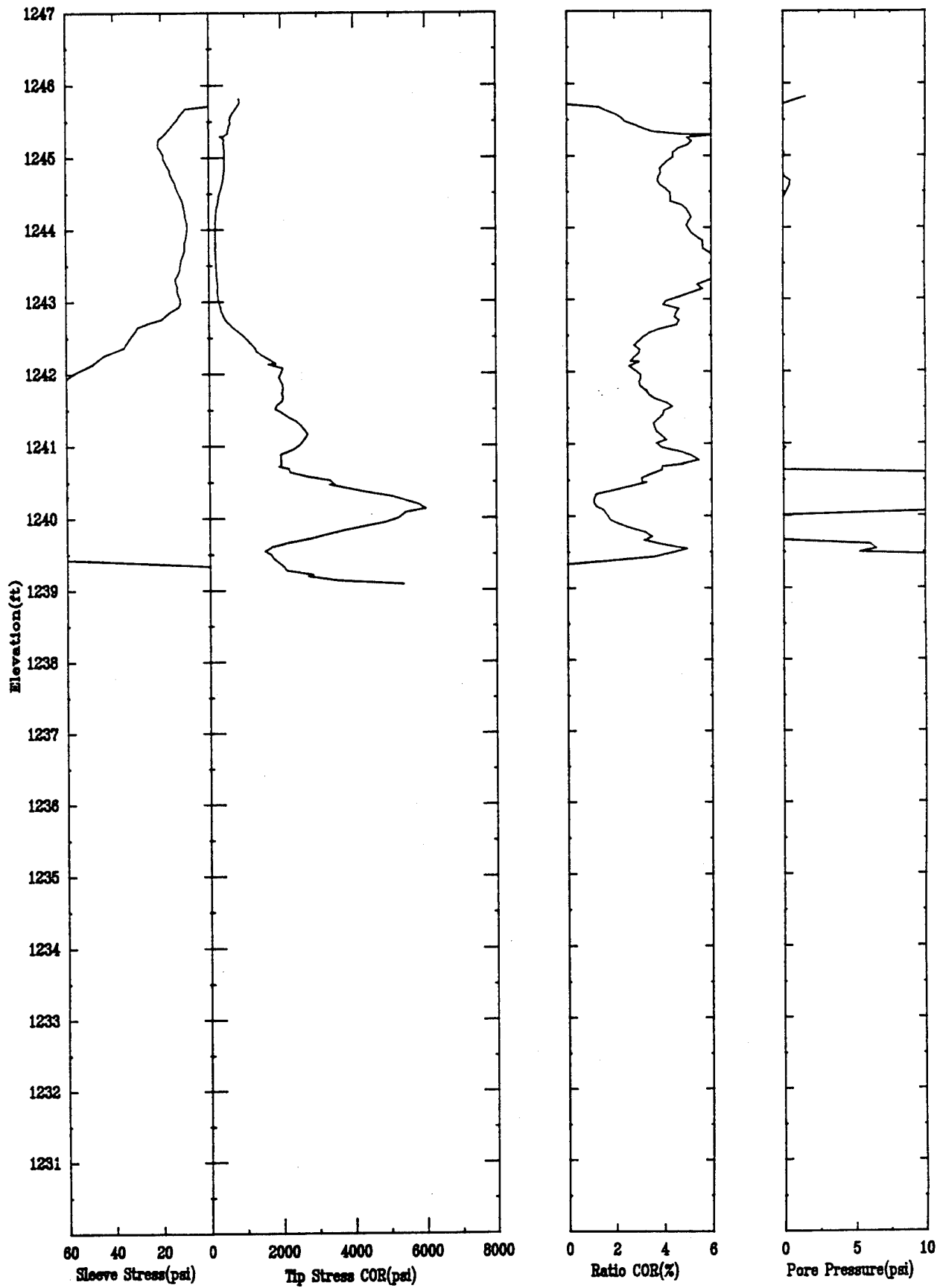
APPLIED RESEARCH ASSOCIATES, INC.

10/02/92

North 155535.

East 2186851.

Elevation 1245.9



OSC-2A

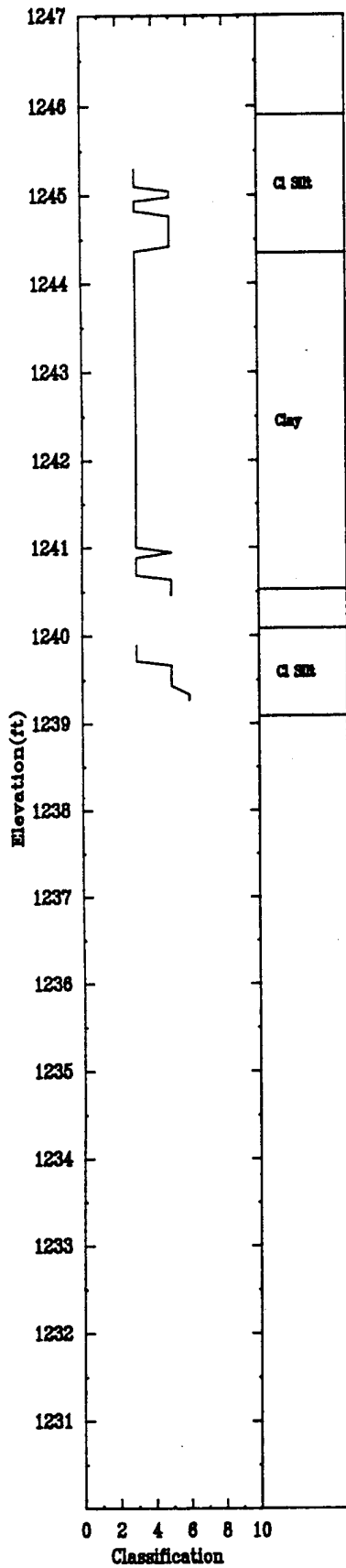
APPLIED RESEARCH ASSOCIATES, INC.

10/02/92

North 155535.

East 2186851.

Elevation 1245.9



OSC-03

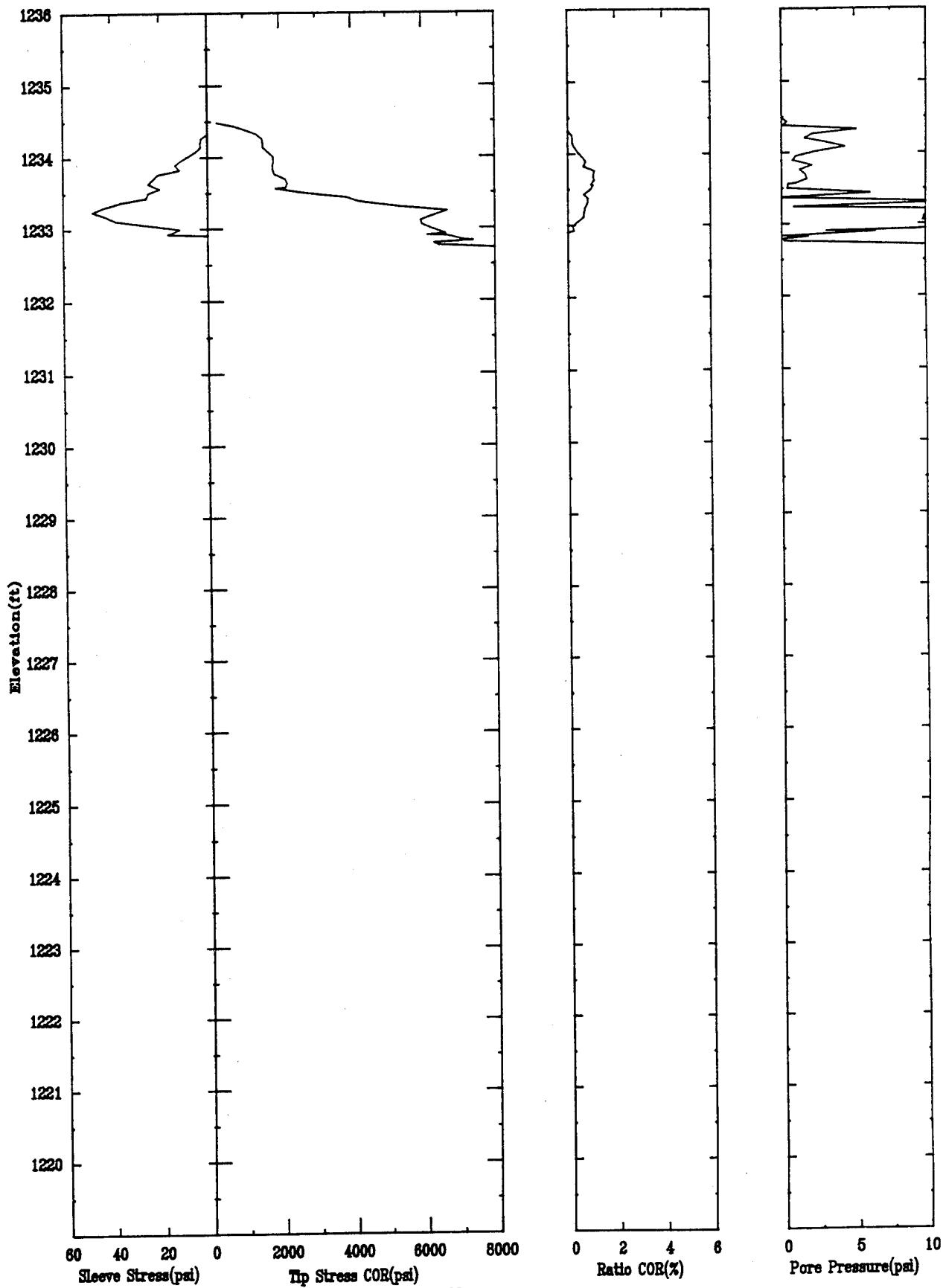
APPLIED RESEARCH ASSOCIATES, INC.

10/02/92

North 155041.

East 2187081.

Elevation 1234.5



OSC-03A

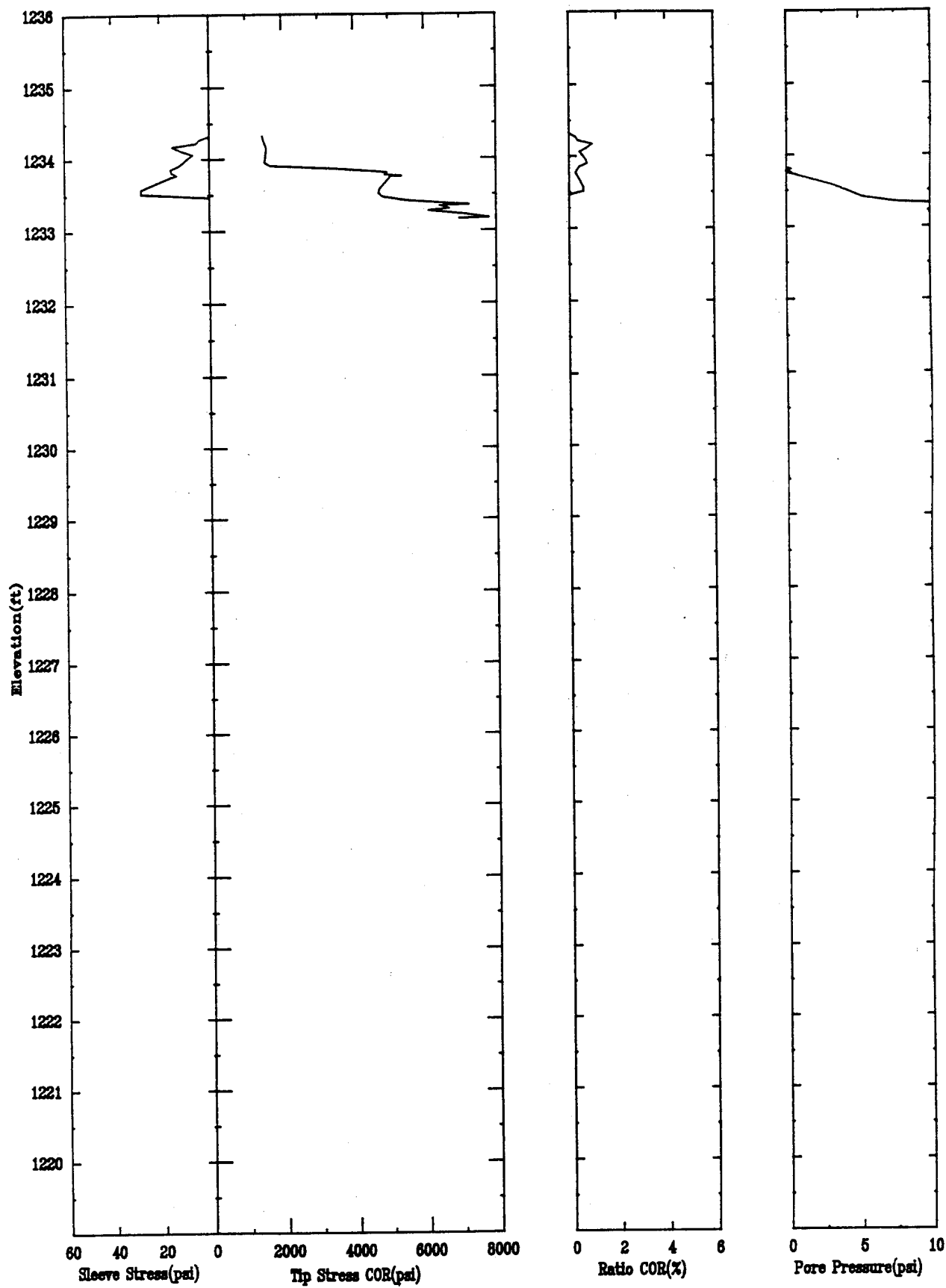
APPLIED RESEARCH ASSOCIATES, INC.

10/02/92

North 155044.

East 2187081.

Elevation 1234.5



OSC-04A

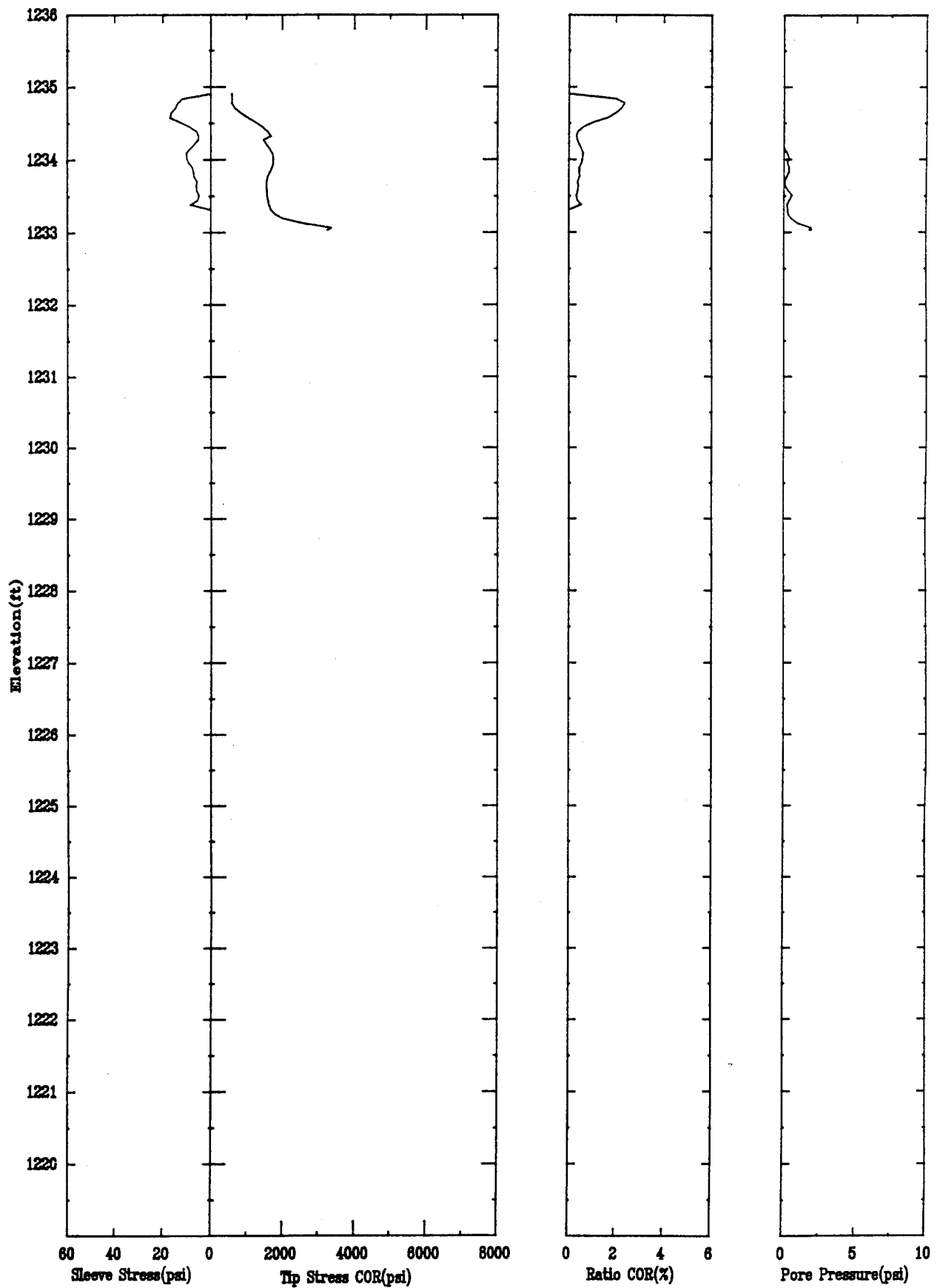
APPLIED RESEARCH ASSOCIATES, INC.

10/02/92

North 155178.

East 2187090.

Elevation 1235.1



OSC-04B

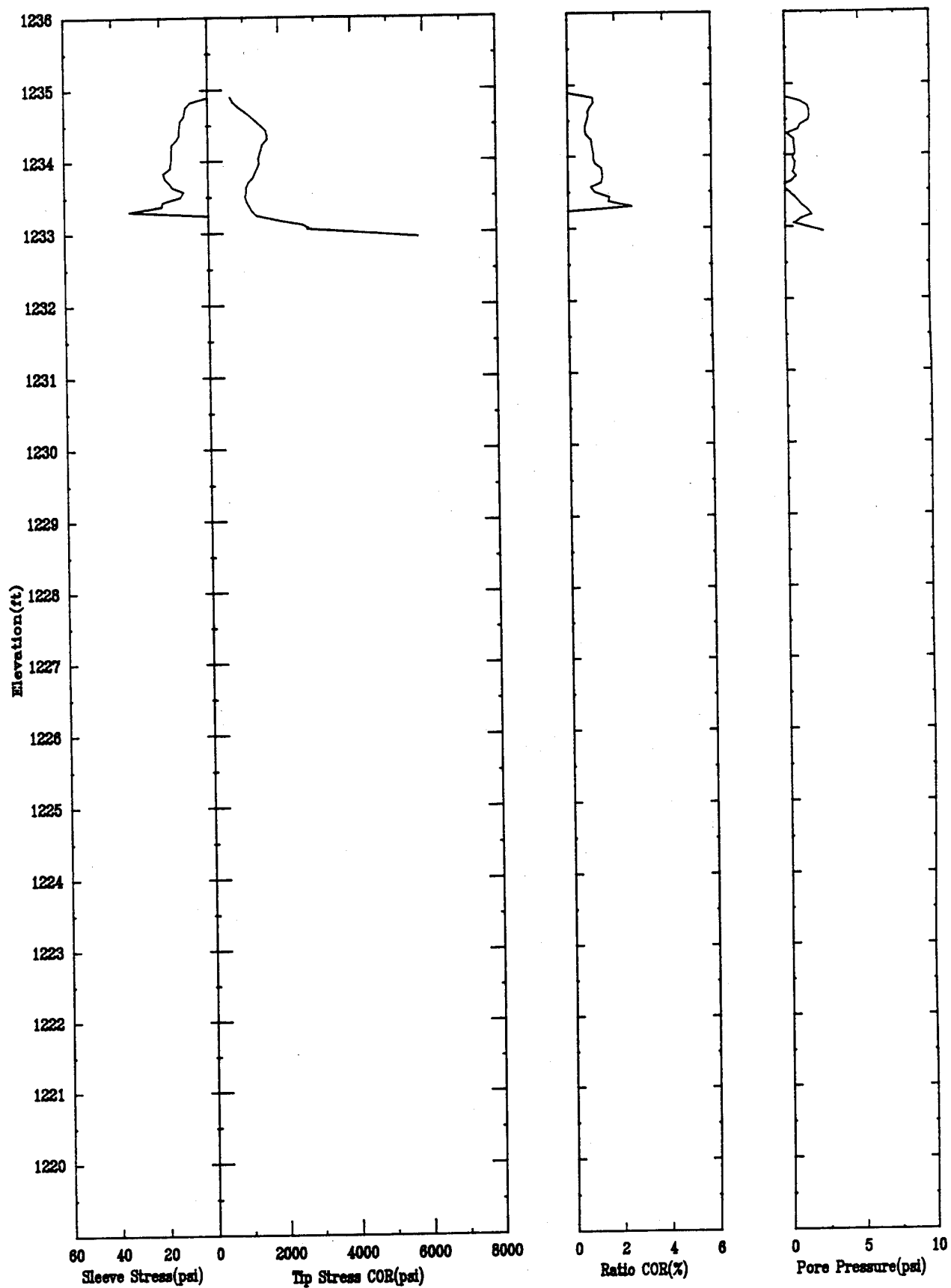
APPLIED RESEARCH ASSOCIATES, INC.

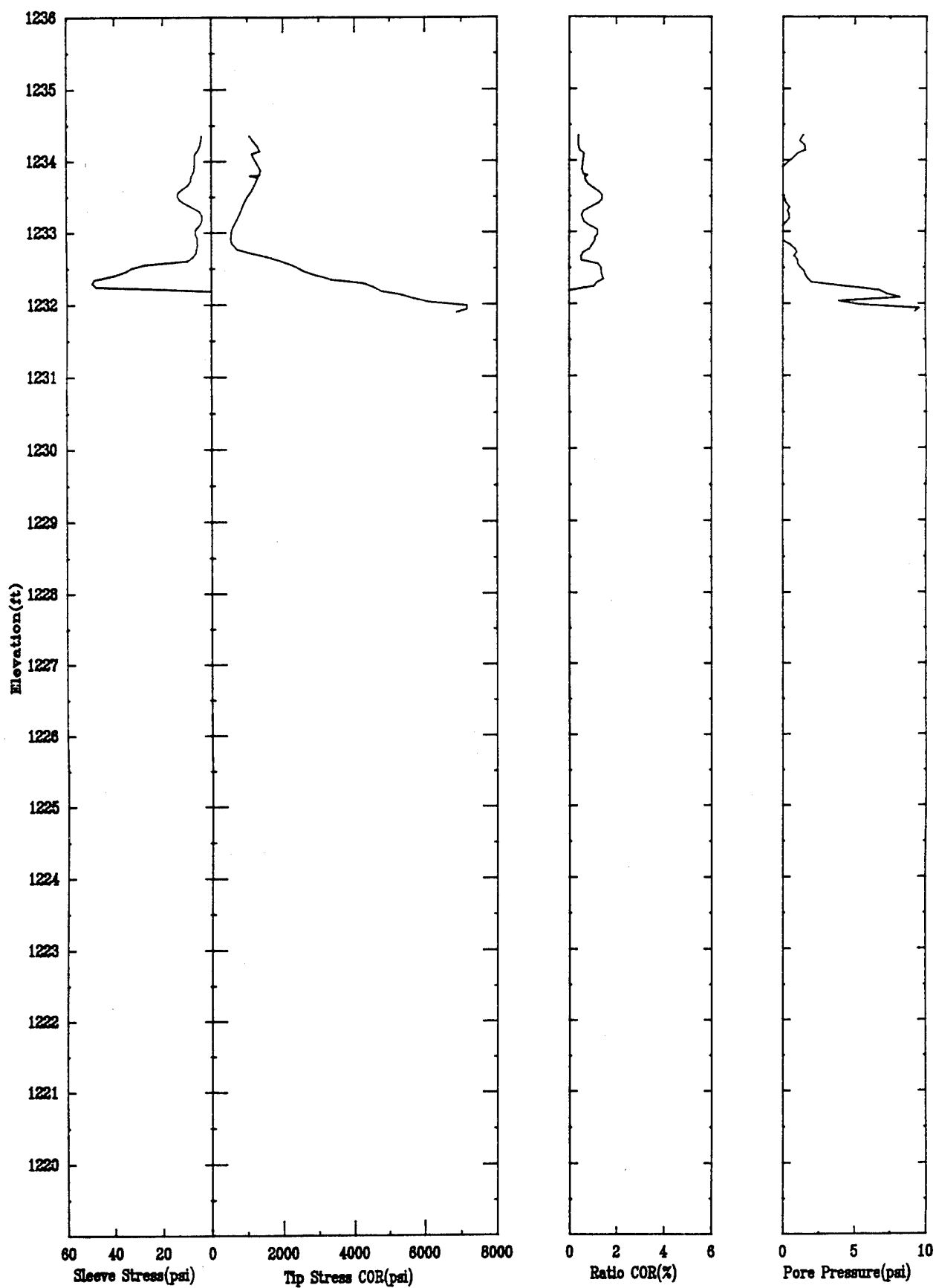
10/02/92

North 155181.

East 2187090.

Elevation 1235.1





OSC-05B

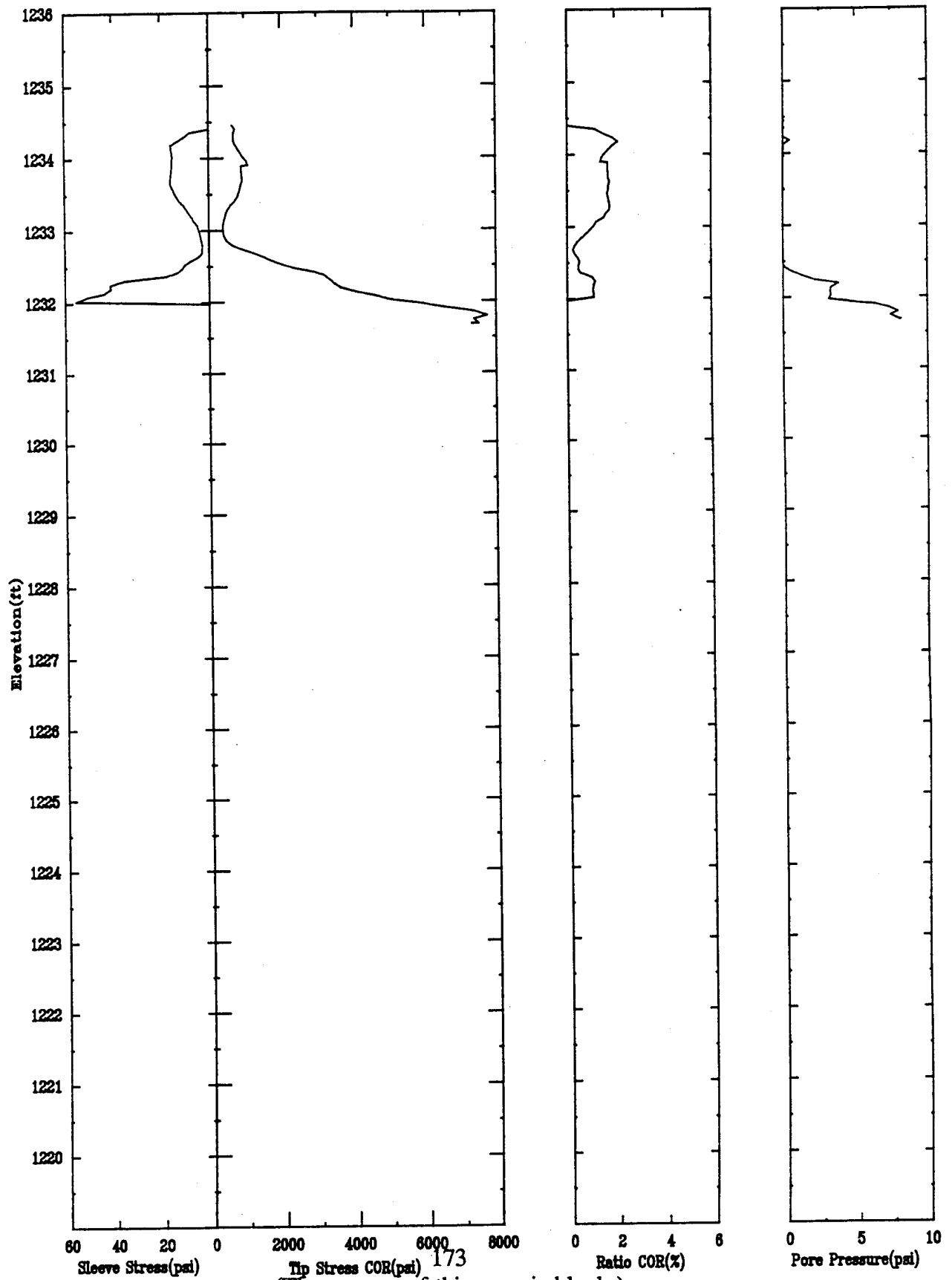
APPLIED RESEARCH ASSOCIATES, INC.

10/02/92

North 155312.

East 2187114.

Elevation 1234.6



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APPENDIX E

LIF-CPT PROFILES FROM LANDFILL NO. 2

LF2-01

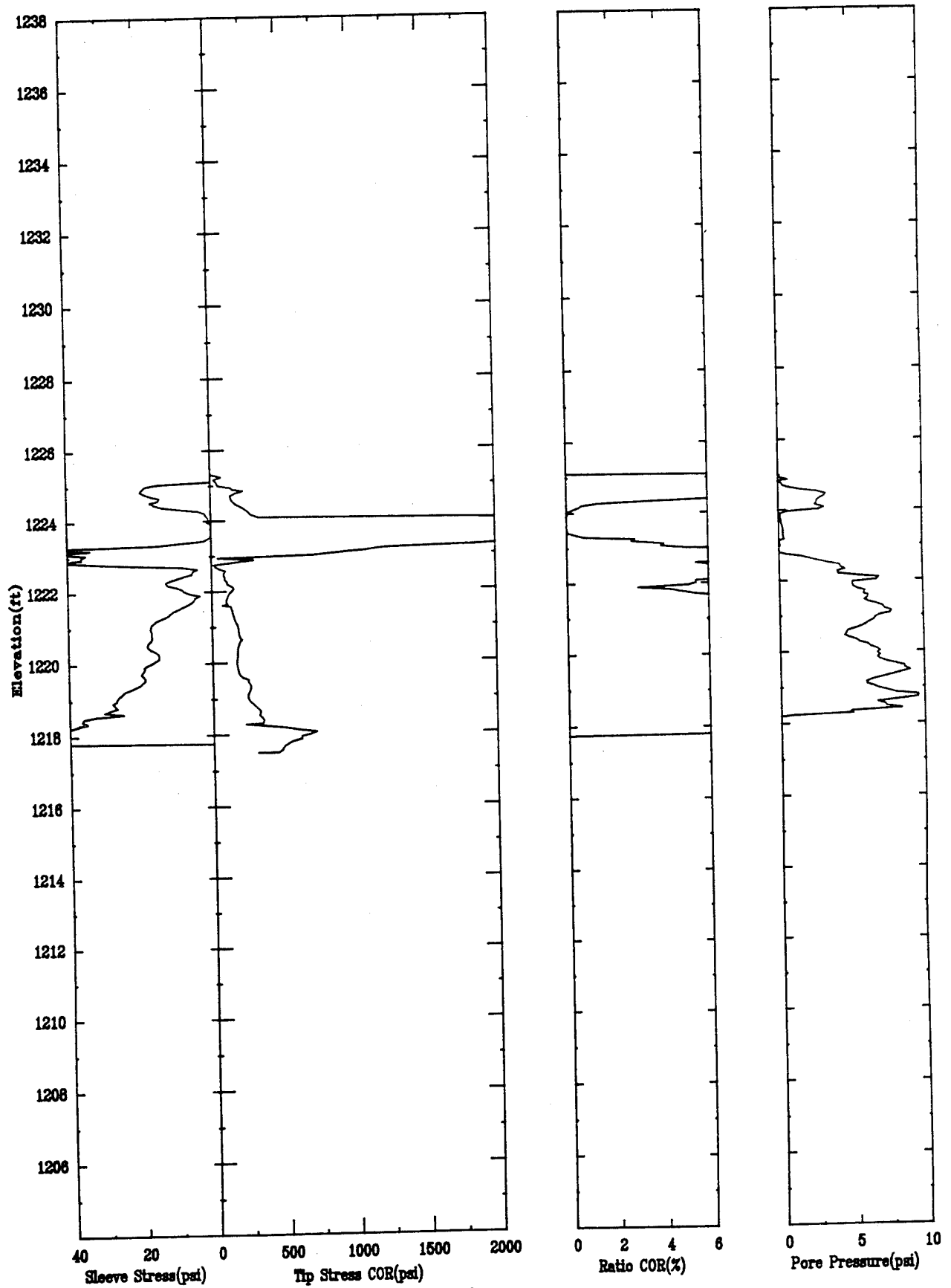
APPLIED RESEARCH ASSOCIATES, INC.

09/28/92

North 150824.

East 2178736.

Elevation 1225.3



LF2-01

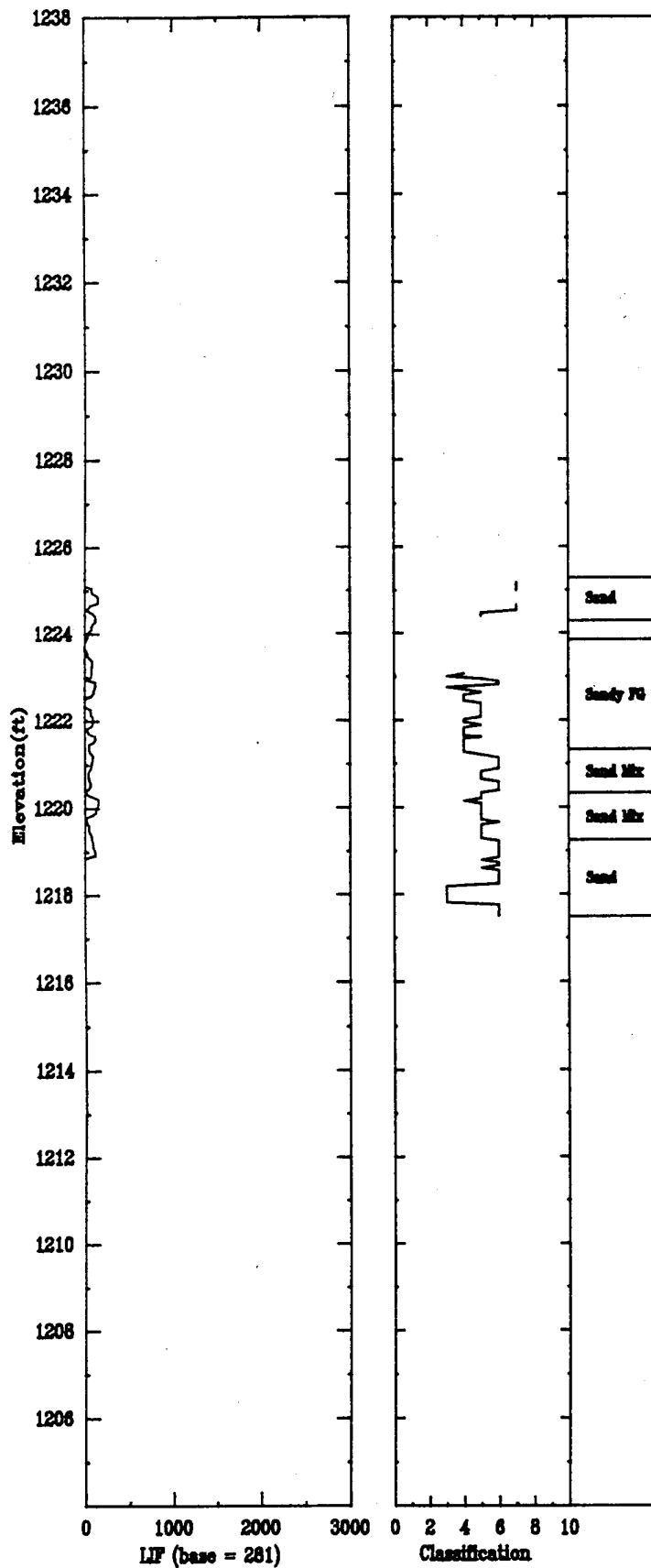
APPLIED RESEARCH ASSOCIATES, INC.

09/28/92

North 150824.

East 2178736.

Elevation 1225.3



LF2-02

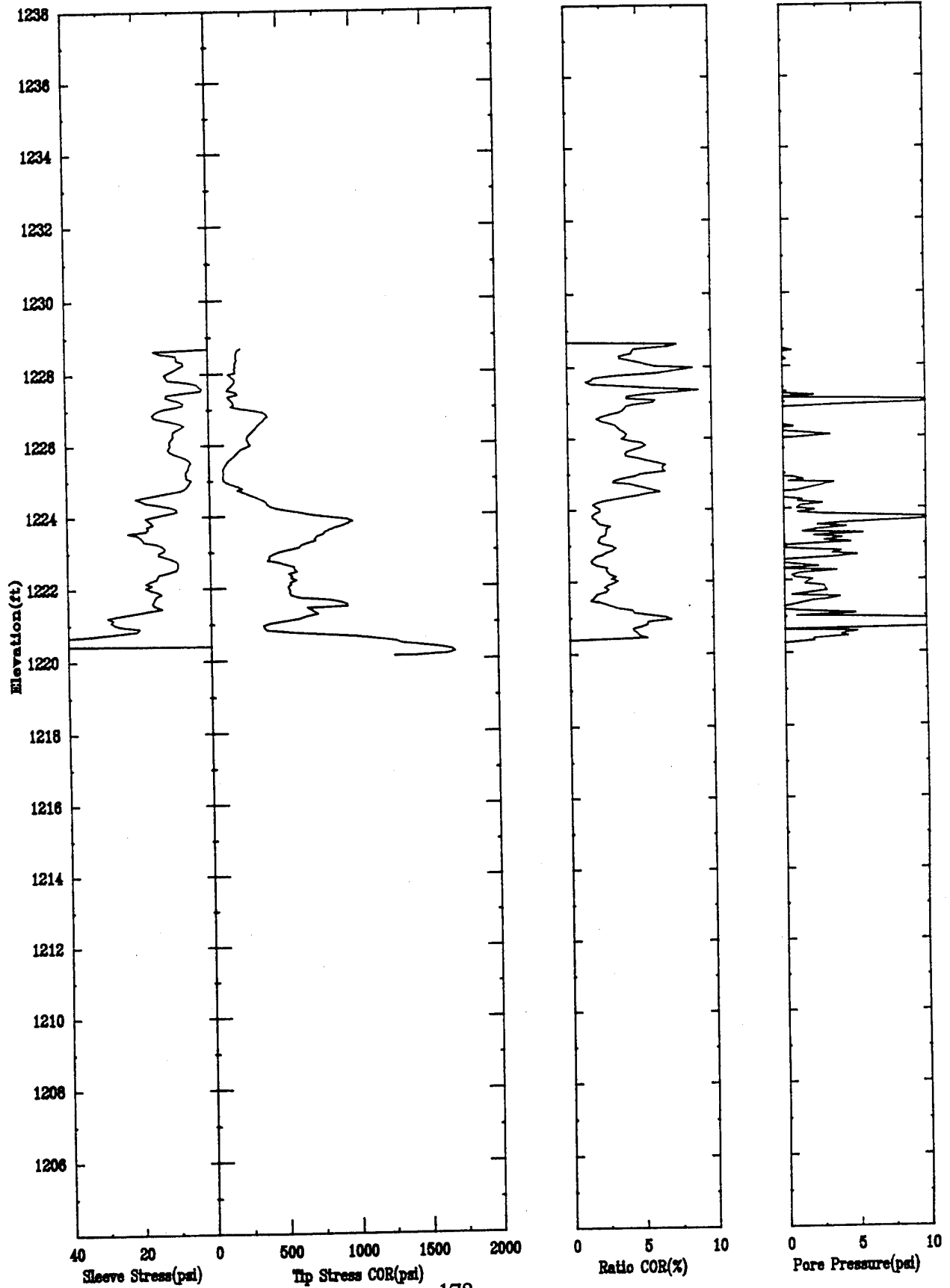
APPLIED RESEARCH ASSOCIATES, INC.

09/28/92

North 150814.

East 2178826.

Elevation 1228.9



LF2-02

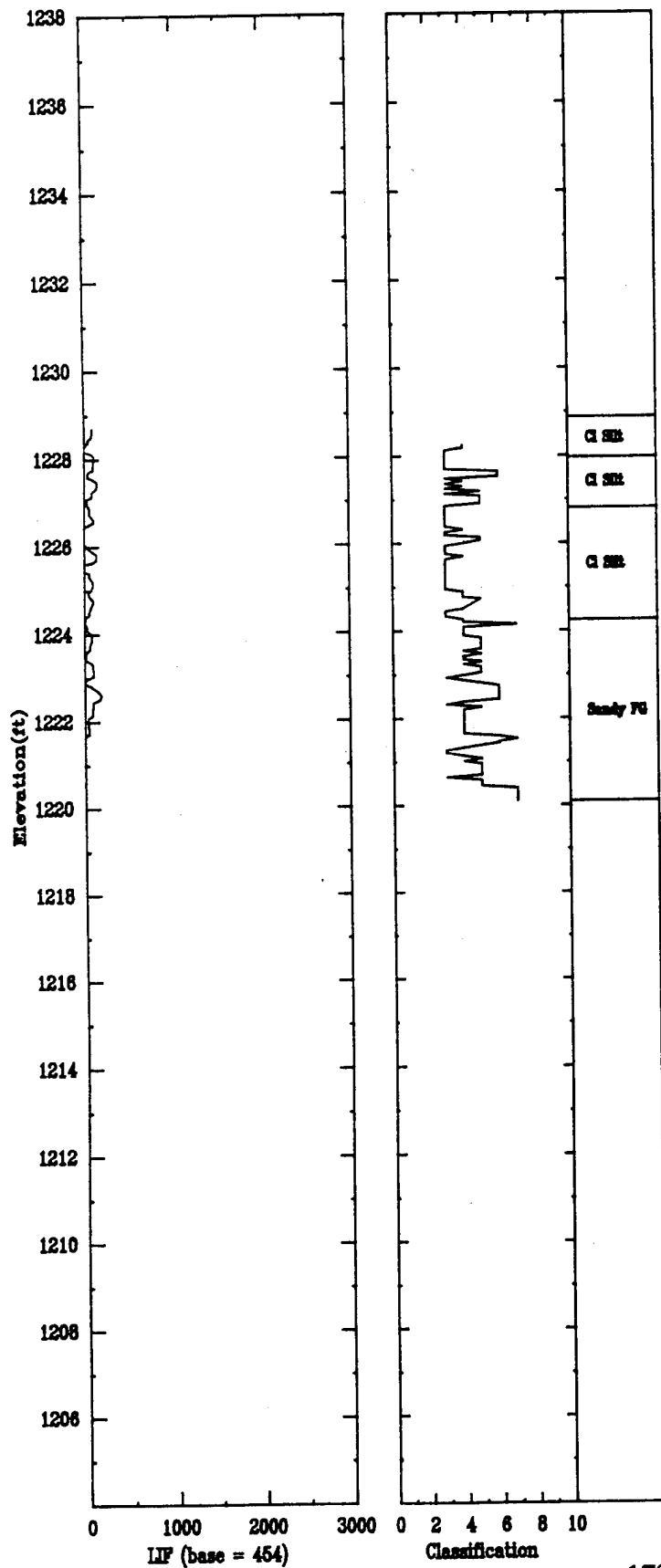
APPLIED RESEARCH ASSOCIATES, INC.

09/28/92

North 150814.

East 2178826.

Elevation 1228.9



LF2-03

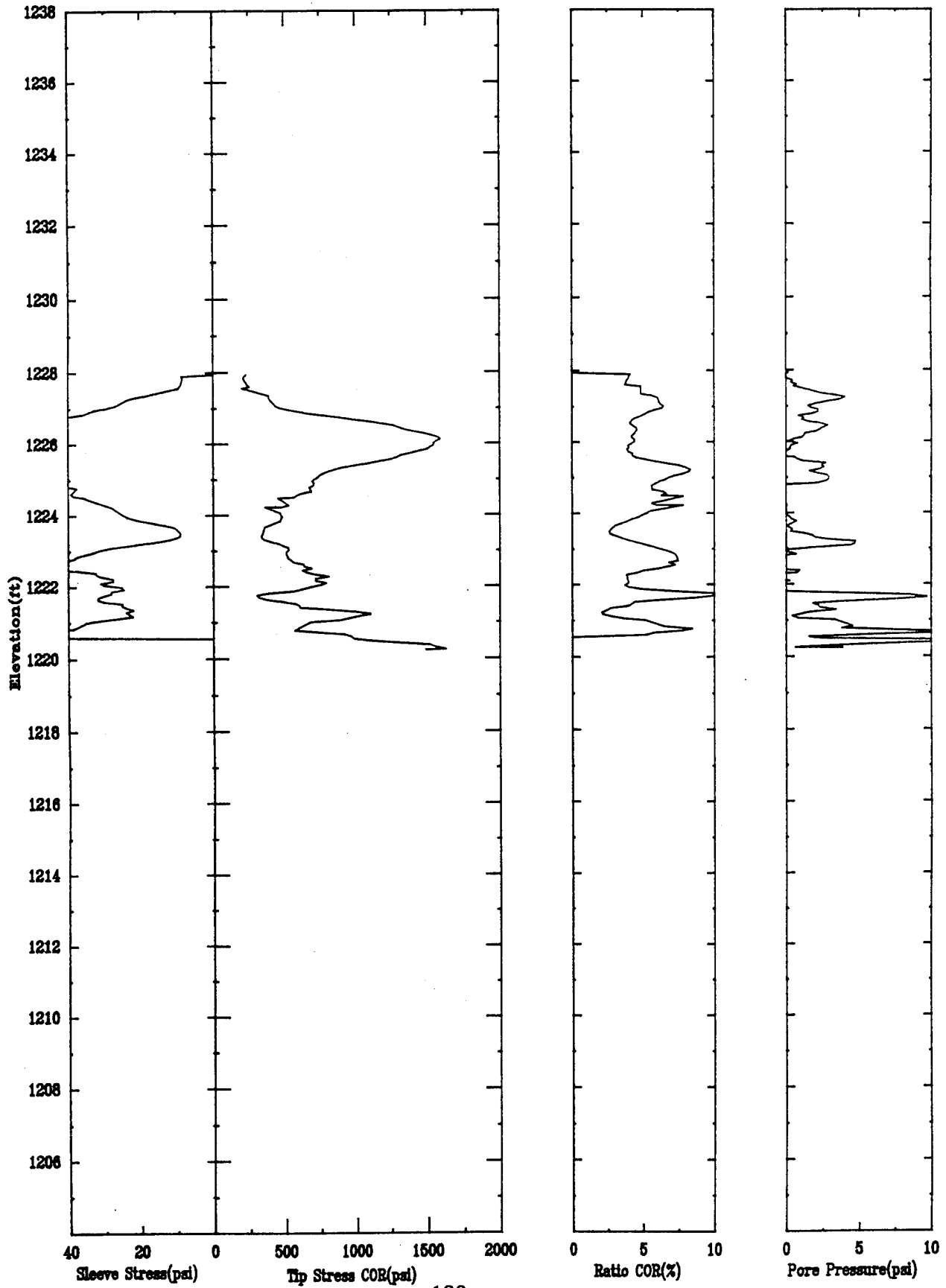
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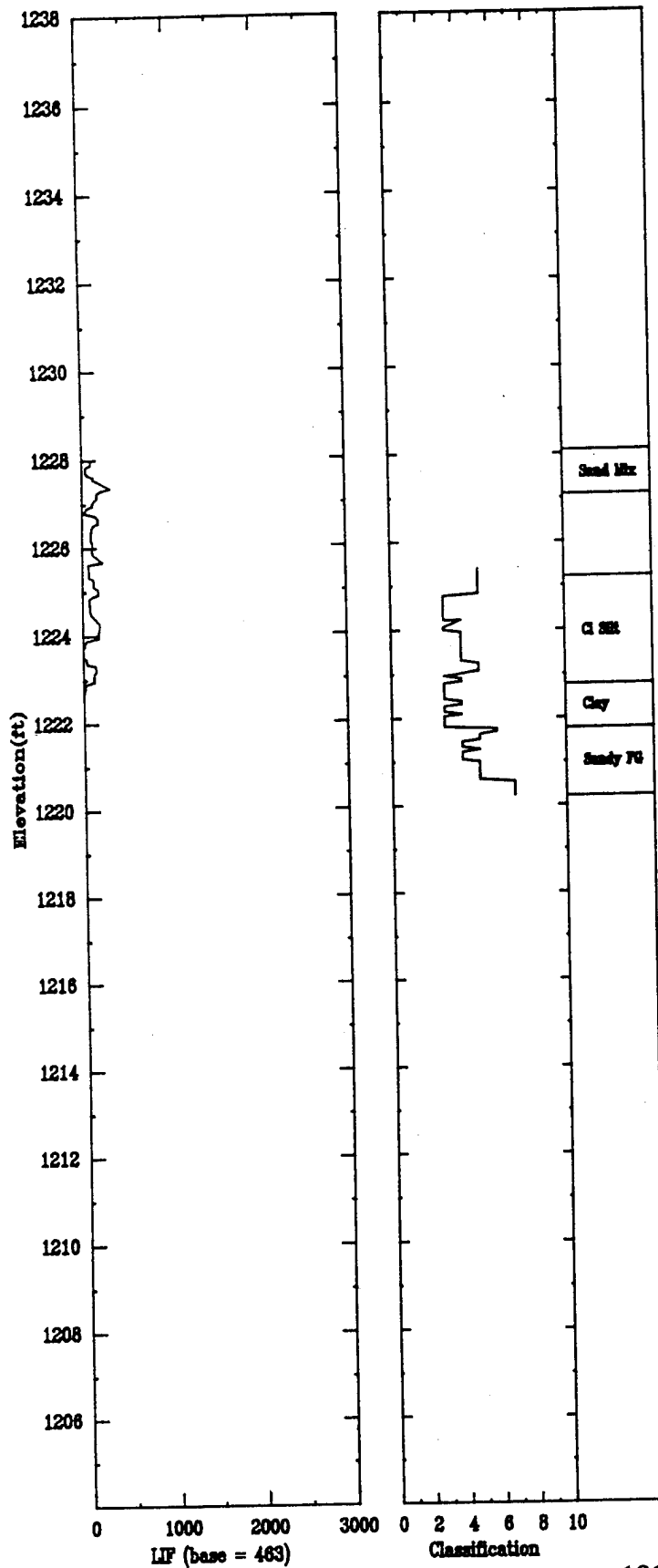
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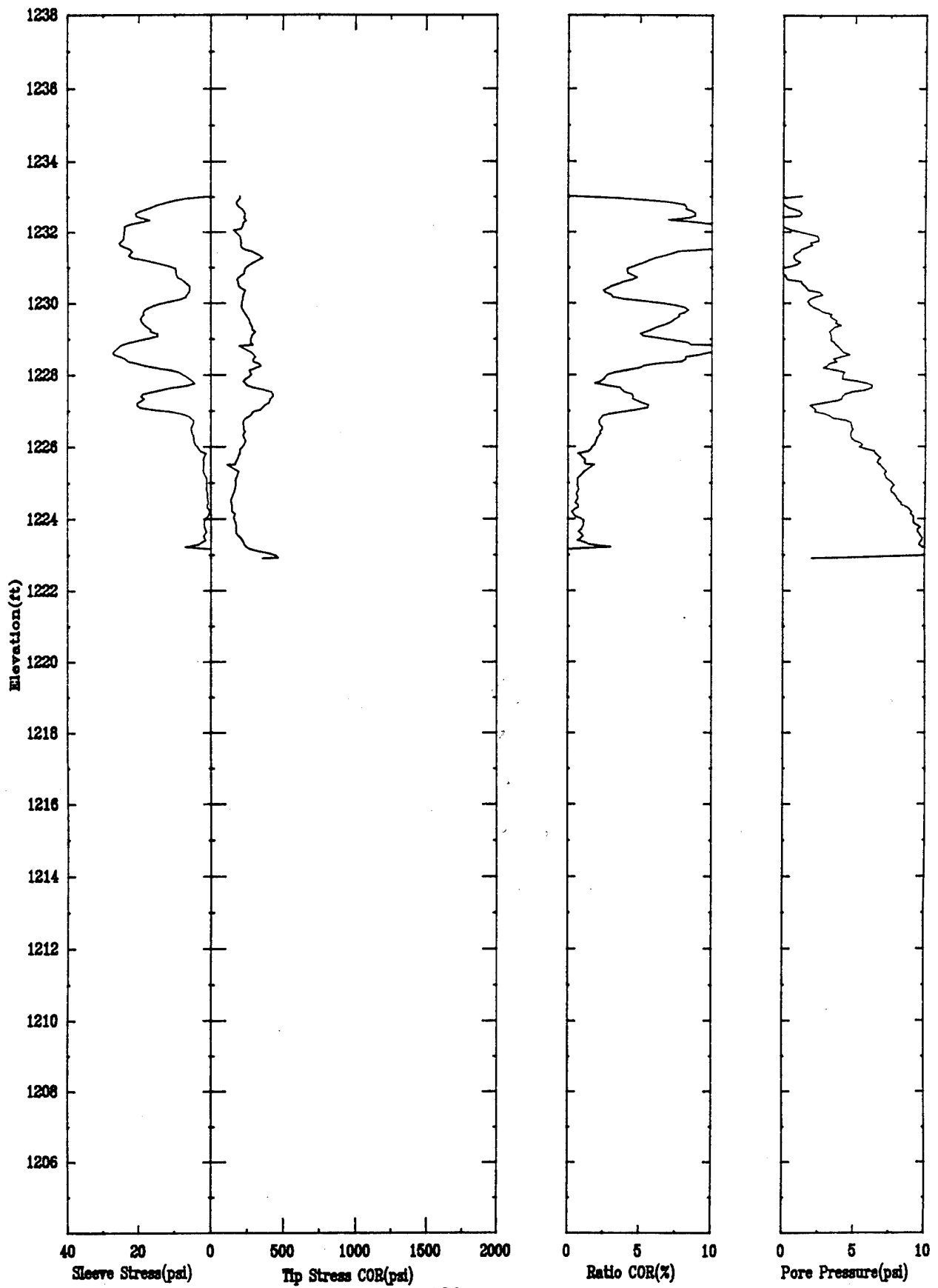
North 150804.

East 2178914.

Elevation 1228.1







LF2-04

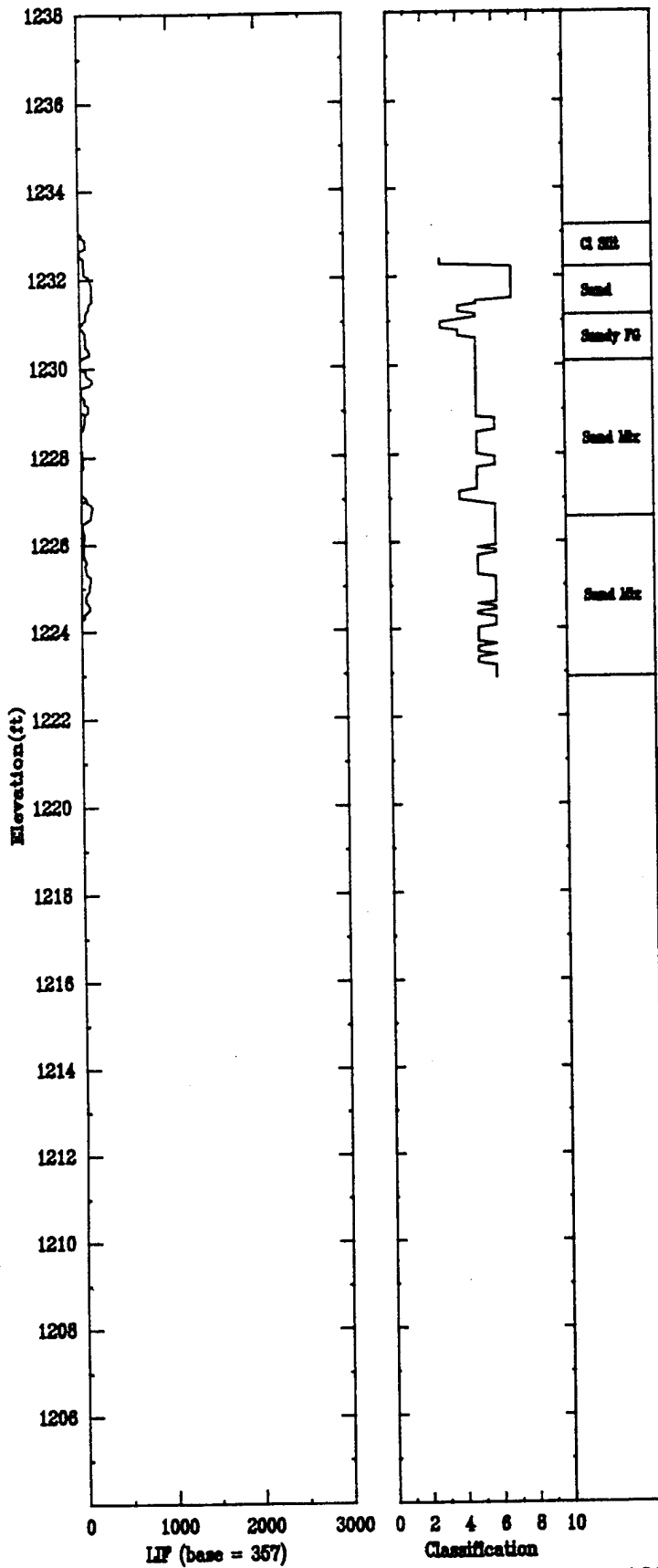
APPLIED RESEARCH ASSOCIATES, INC.

09/28/92

North 150717.

East 2178921.

Elevation 1233.2



LF2-05

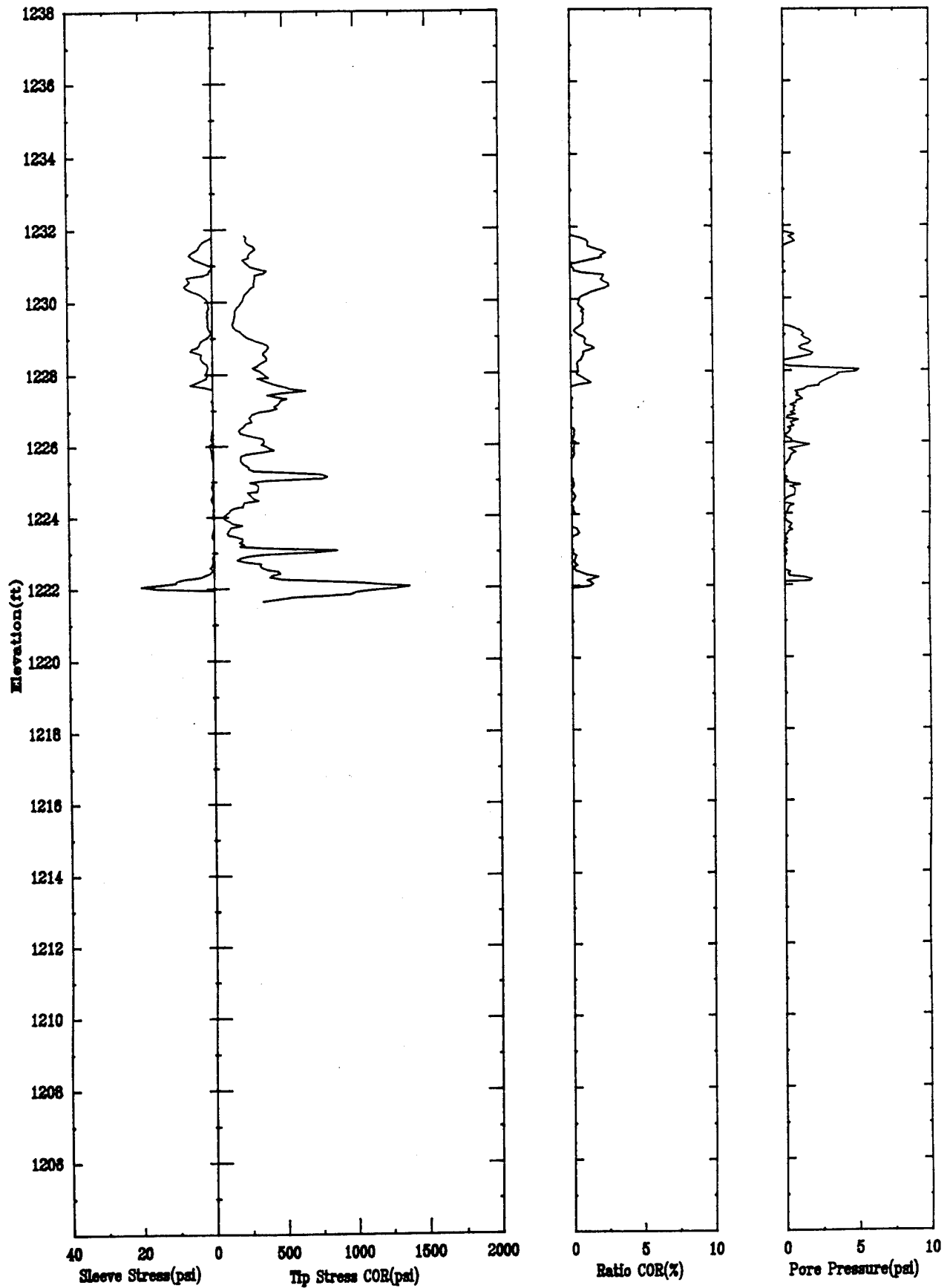
APPLIED RESEARCH ASSOCIATES, INC.

09/28/92

North 150719.

East 2178882.

Elevation 1232.0



LF2-05

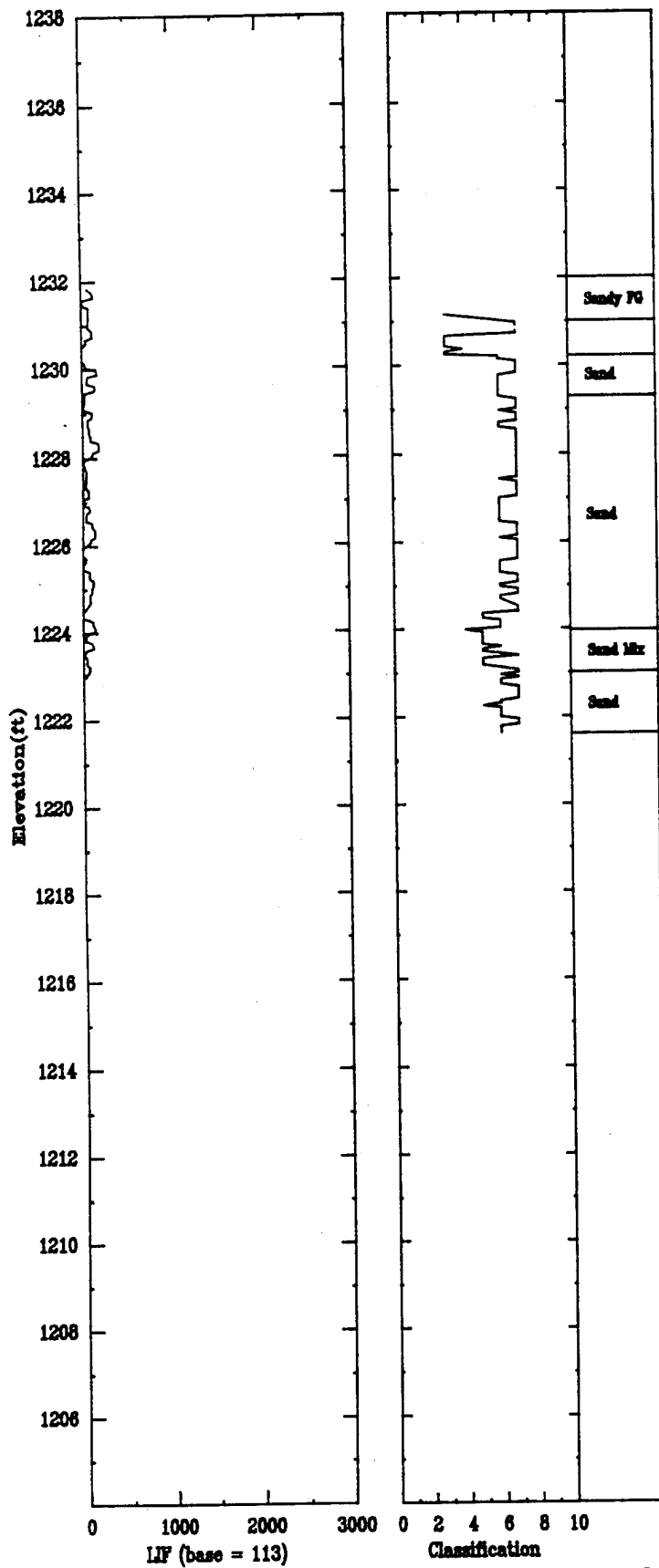
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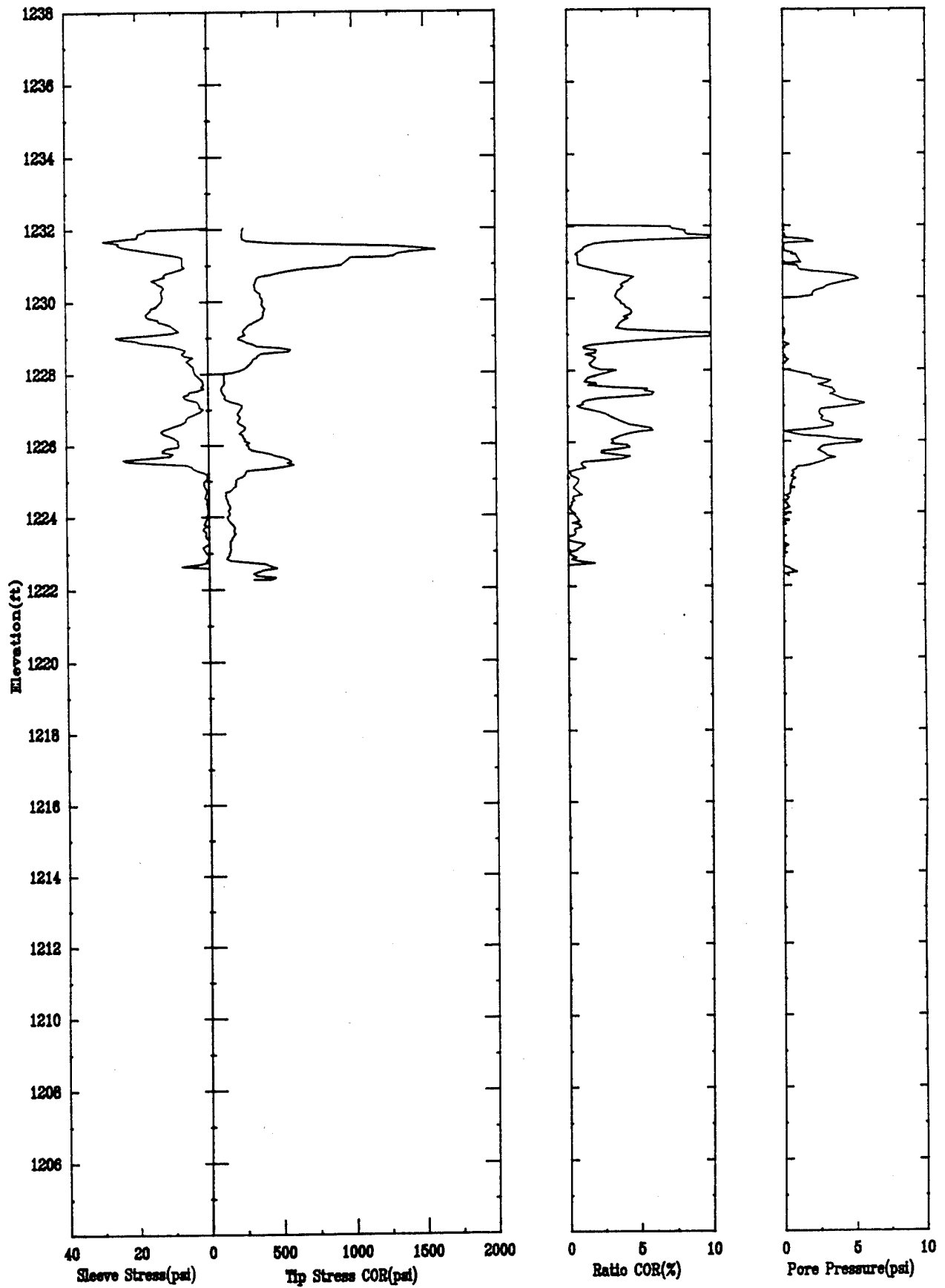
09/28/92

North 150719.

East 2178882.

Elevation 1232.0





LF2-06

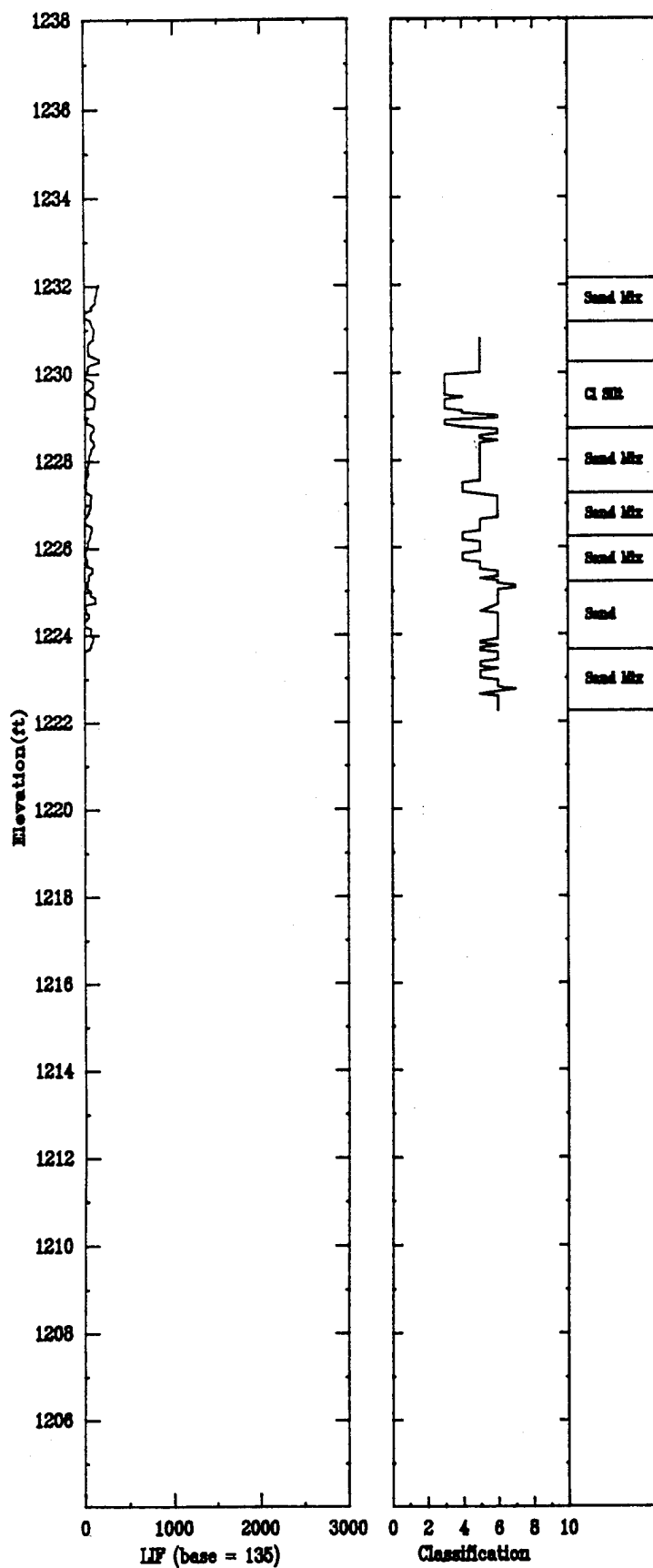
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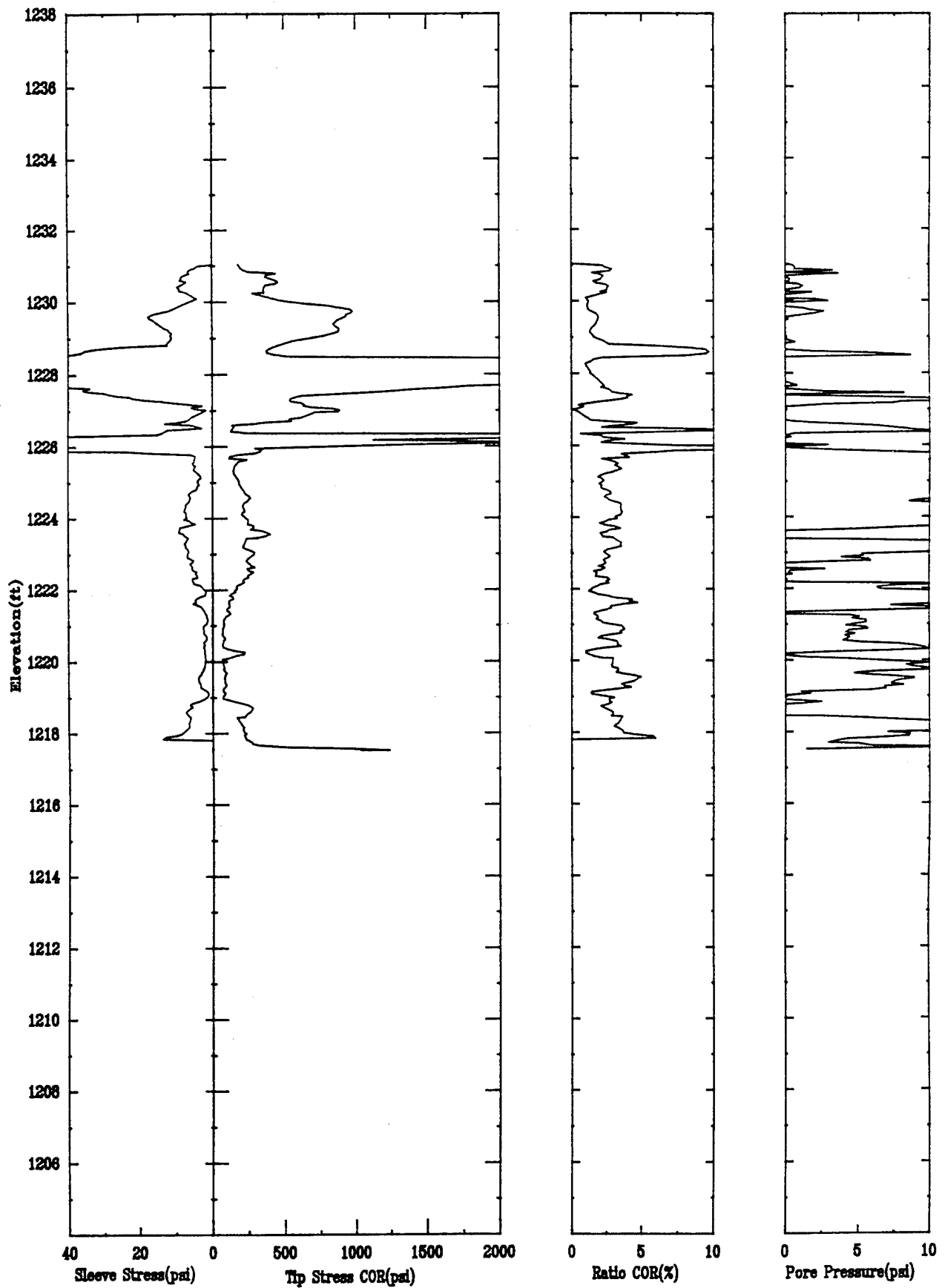
09/28/92

North 150723.

East 2178841.

Elevation 1232.2





LF2-07

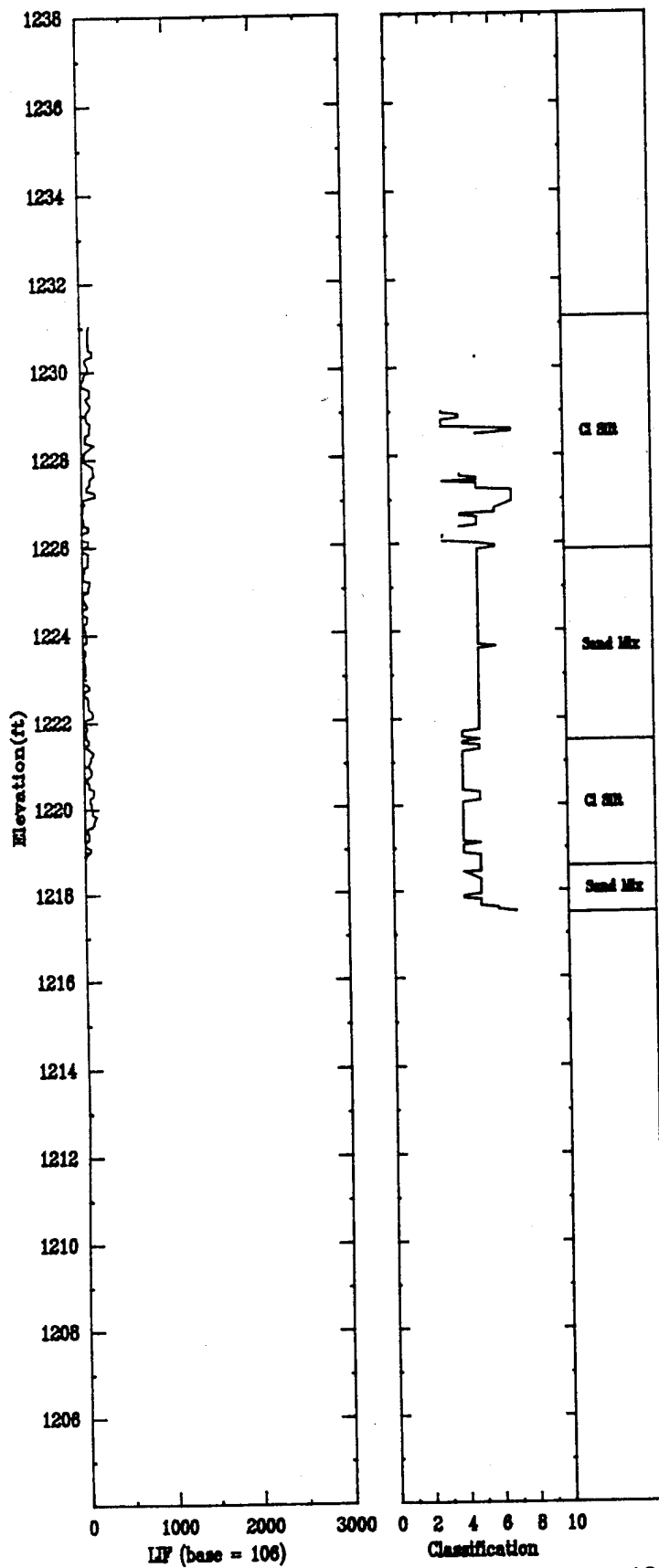
APPLIED RESEARCH ASSOCIATES, INC.

09/29/92

North 150727.

East 2178785.

Elevation 1231.2



LF2-08

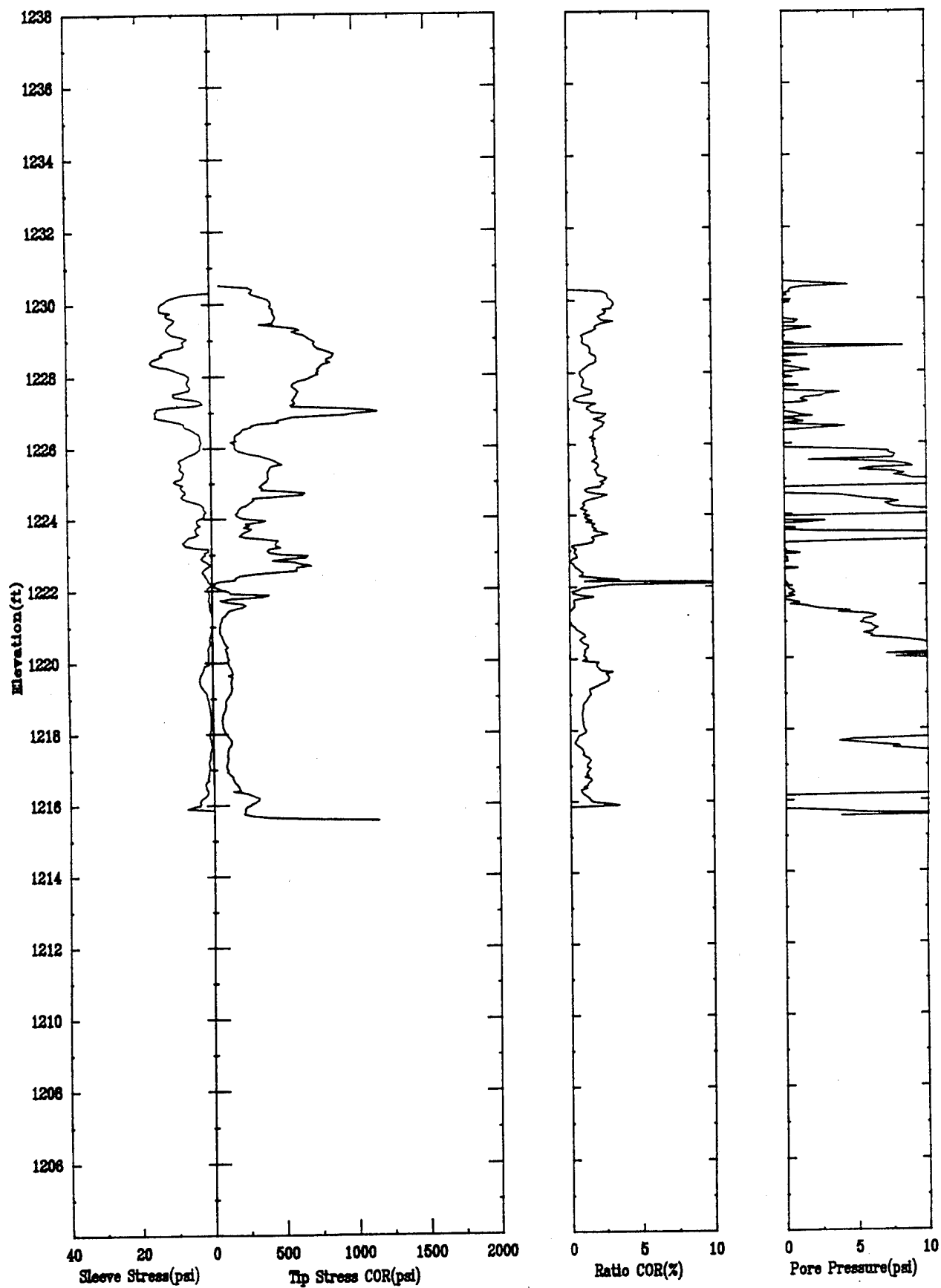
APPLIED RESEARCH ASSOCIATES, INC.

09/29/92

North 150731.

East 2178741.

Elevation 1230.5



LF2-08

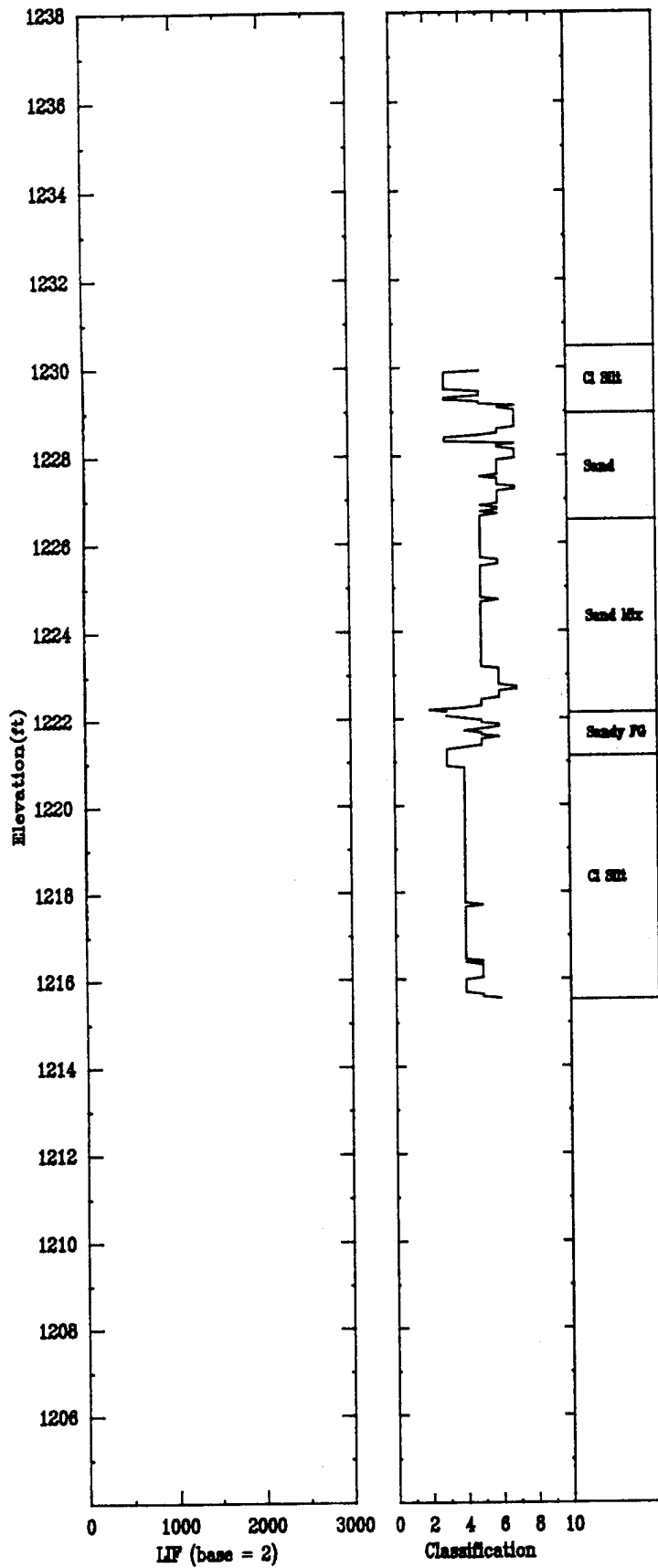
APPLIED RESEARCH ASSOCIATES, INC.

09/29/92

North 150731.

East 2178741.

Elevation 1230.5



LF2-09

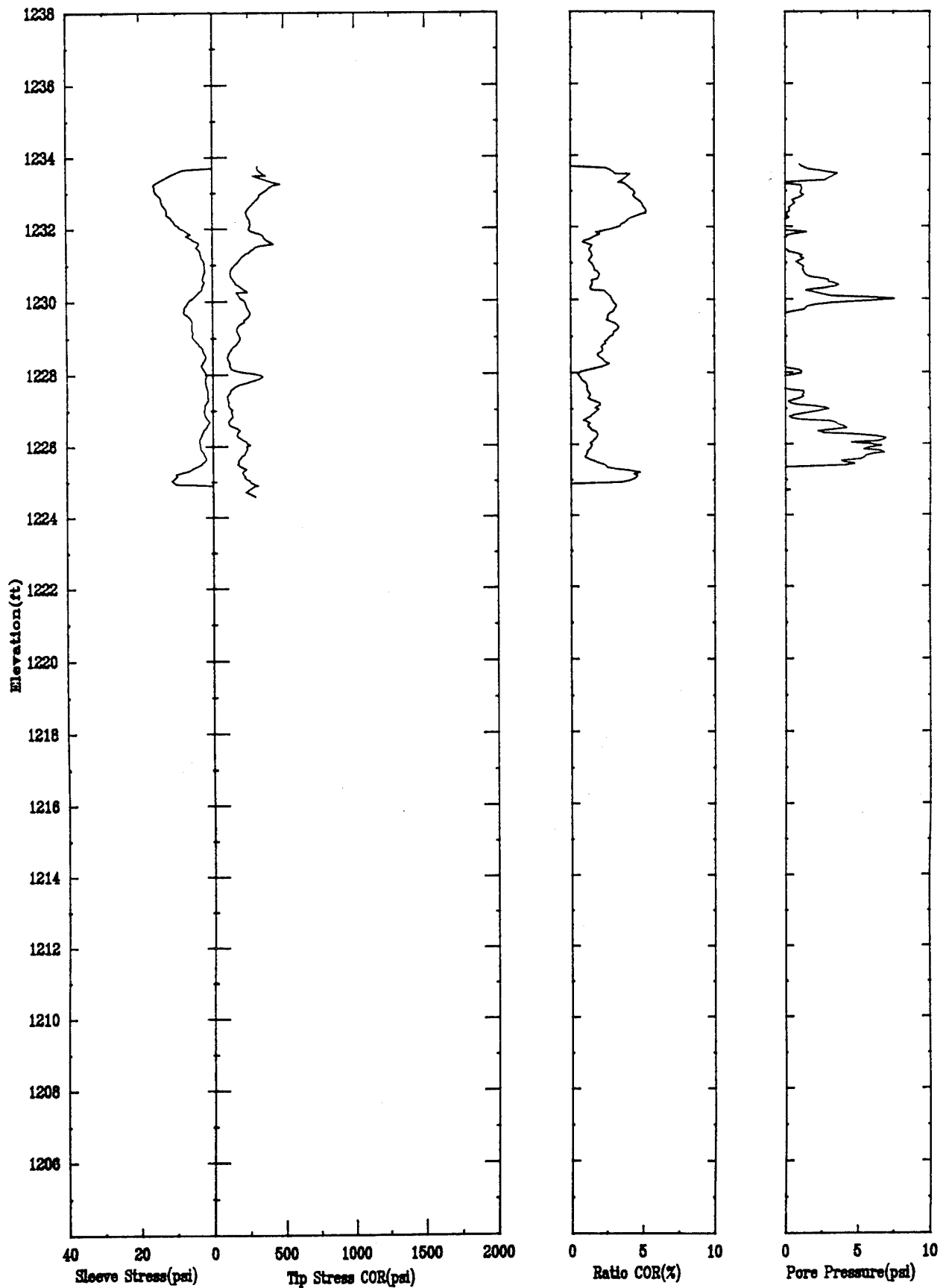
APPLIED RESEARCH ASSOCIATES, INC.

09/29/92

North 150649.

East 2178755.

Elevation 1233.9



LF2-09

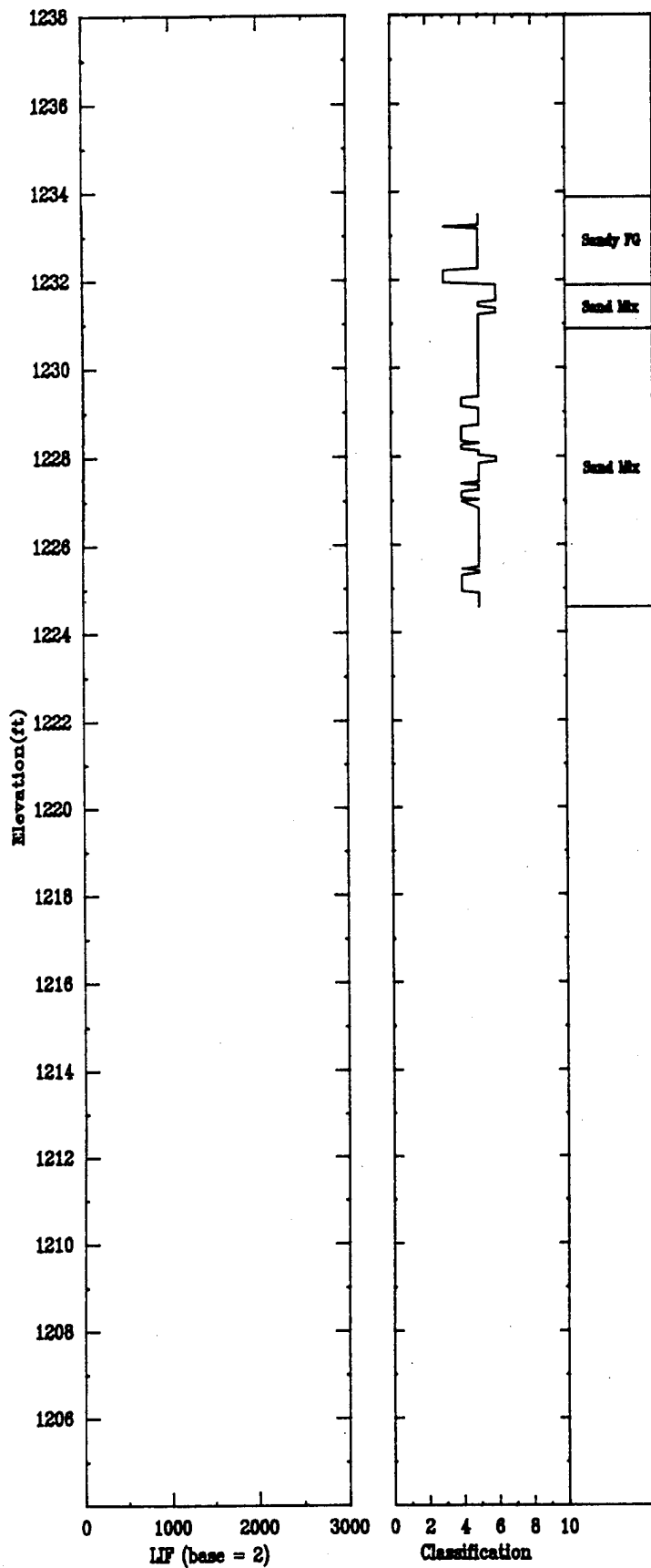
APPLIED RESEARCH ASSOCIATES, INC.

09/29/92

North 150649.

East 2178755.

Elevation 1233.9



LF2-10

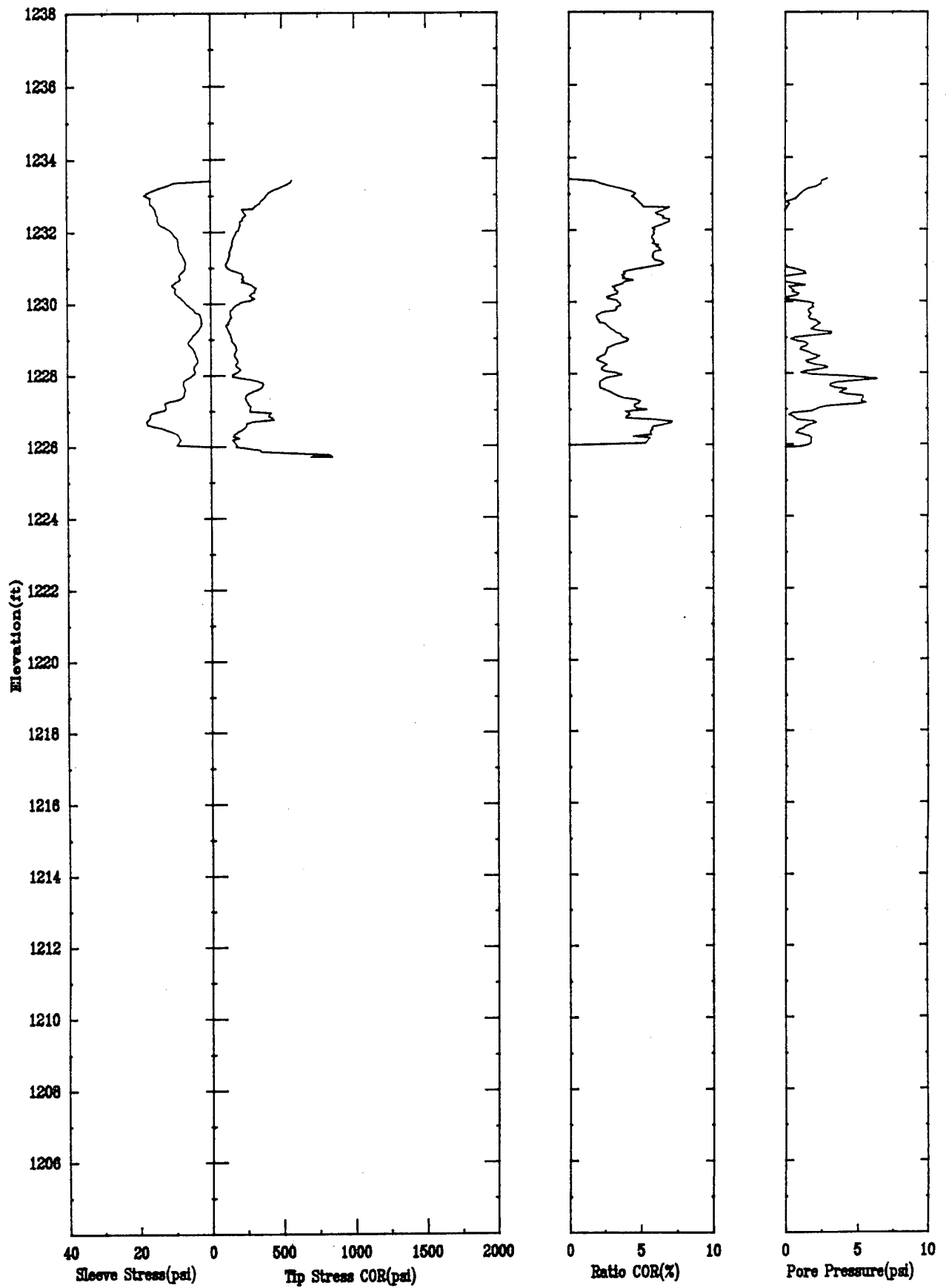
APPLIED RESEARCH ASSOCIATES, INC.

09/29/92

North 150659.

East 2178851.

Elevation 1233.6



LF2-10

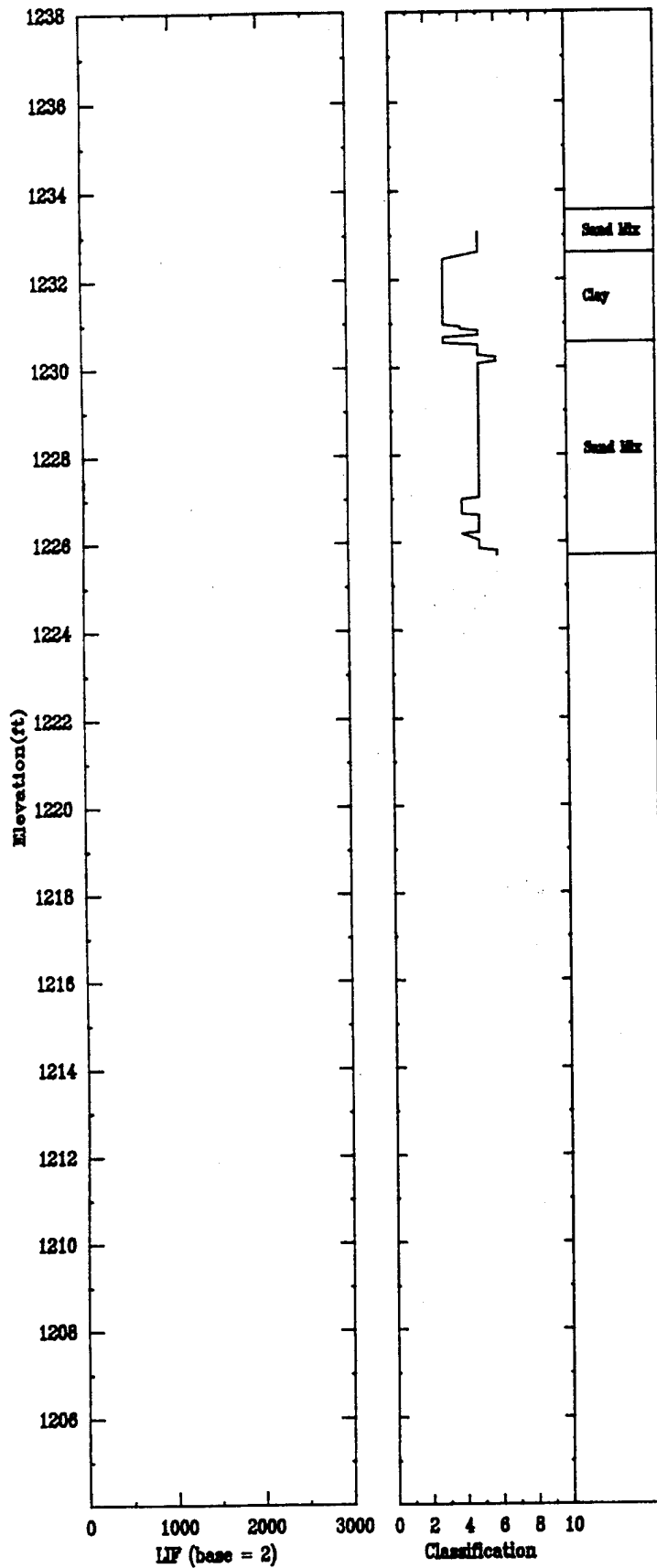
APPLIED RESEARCH ASSOCIATES, INC.

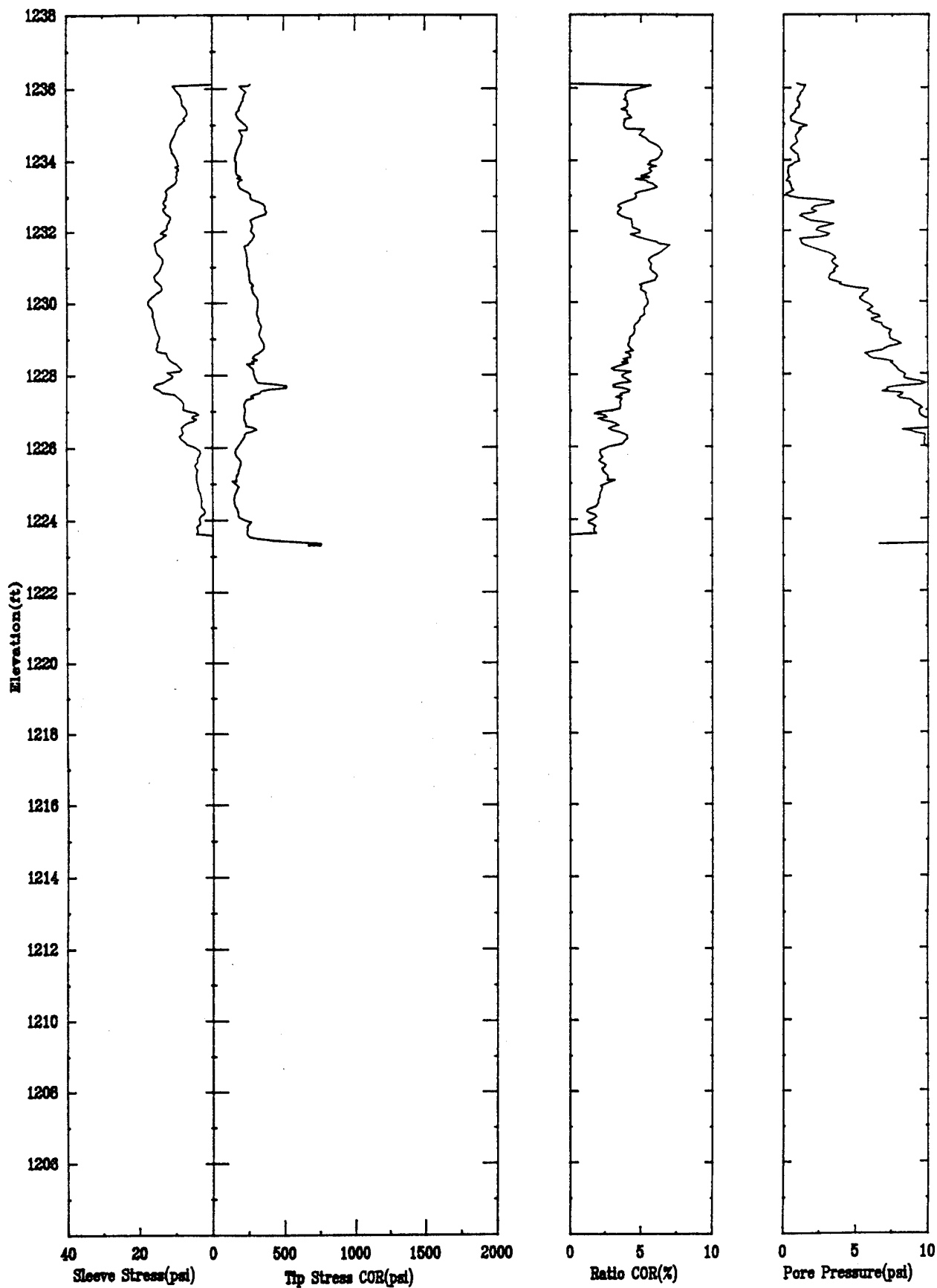
09/29/92

North 150659.

East 2178851.

Elevation 1233.6





LF2-11

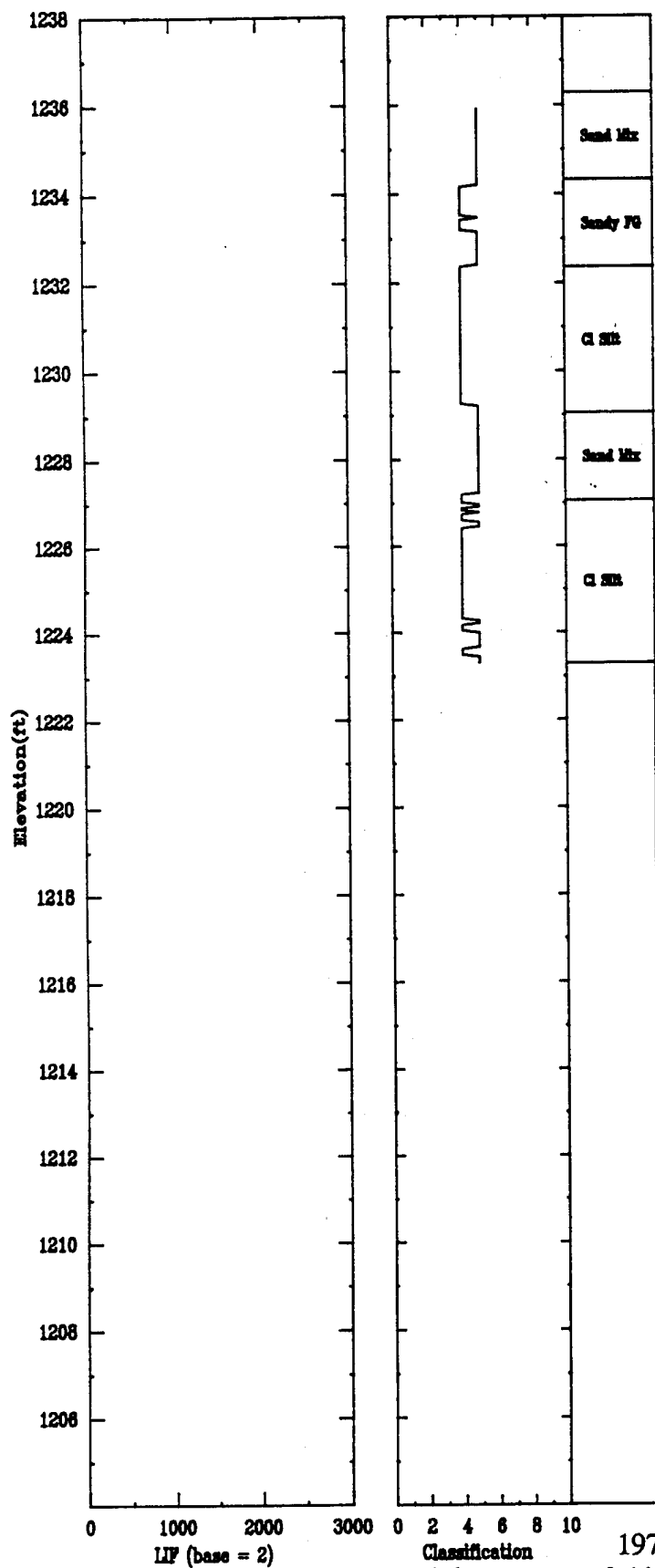
APPLIED RESEARCH ASSOCIATES, INC.

09/29/92

North 150637.

East 2178932.

Elevation 1236.3



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APPENDIX F

LIF-CPT PROFILES FROM LANDFILL NO. 4

LF4-01

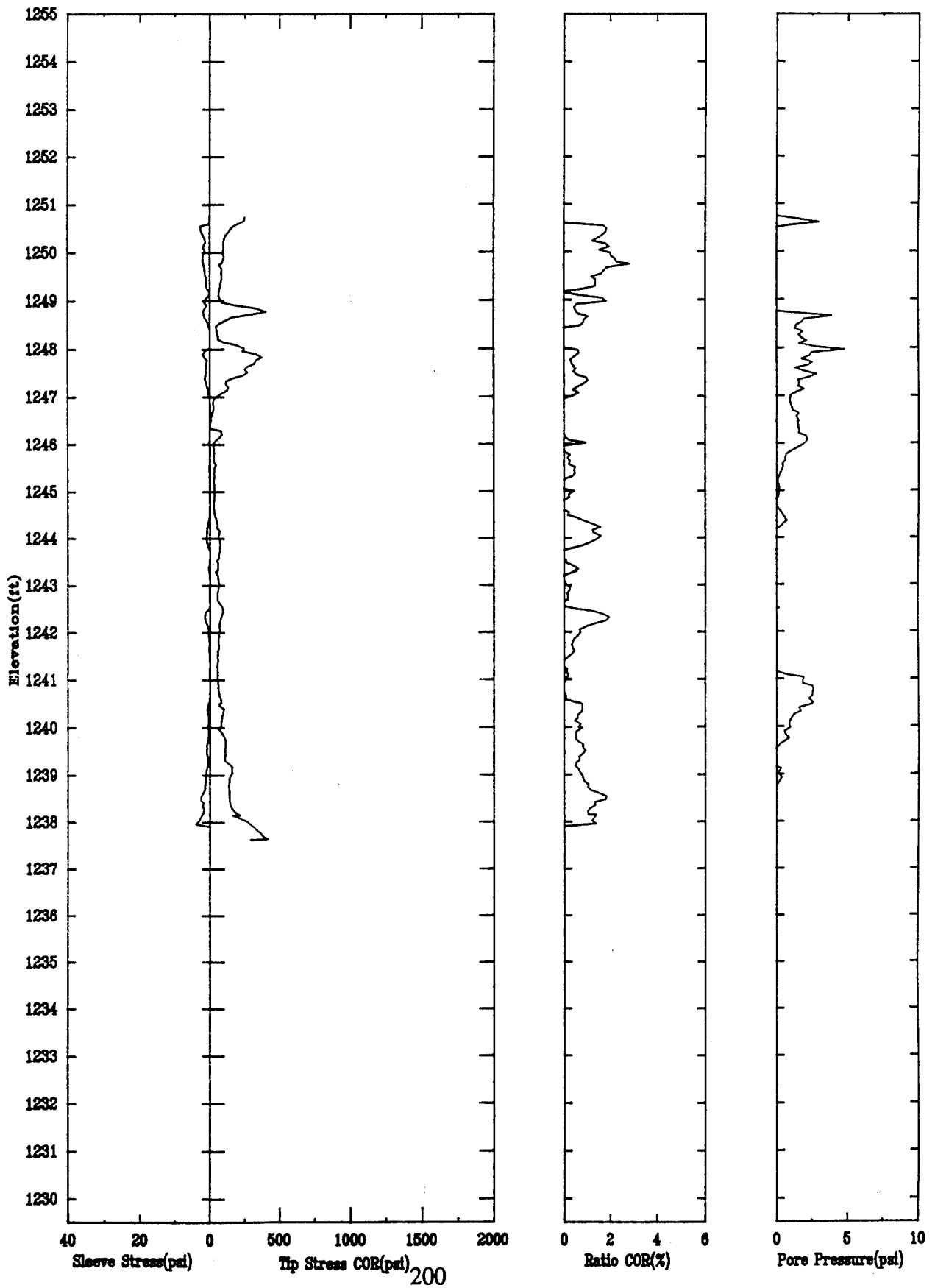
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150657.

East 2177654.

Elevation 1250.8



LF4-01

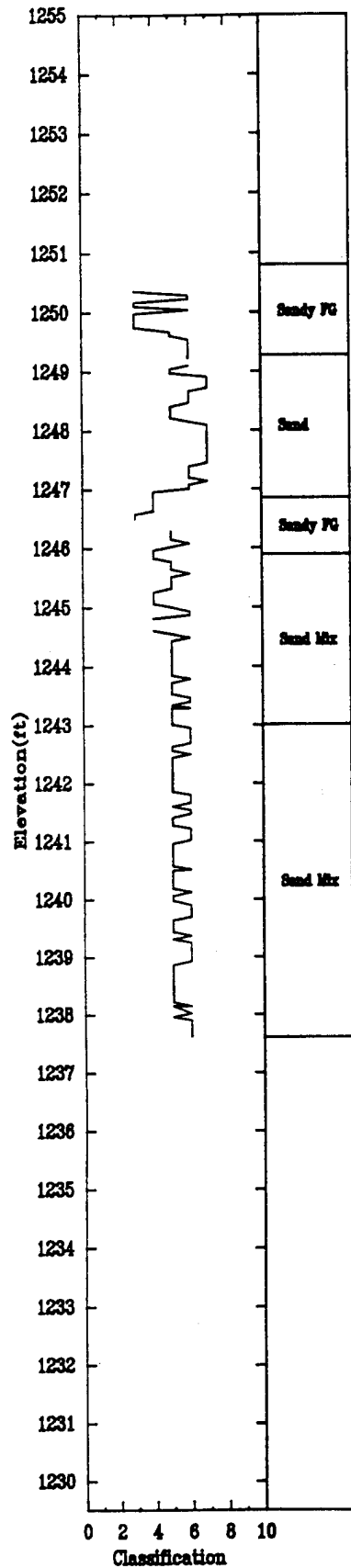
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150657.

East 2177654.

Elevation 1250.8



LF4-02

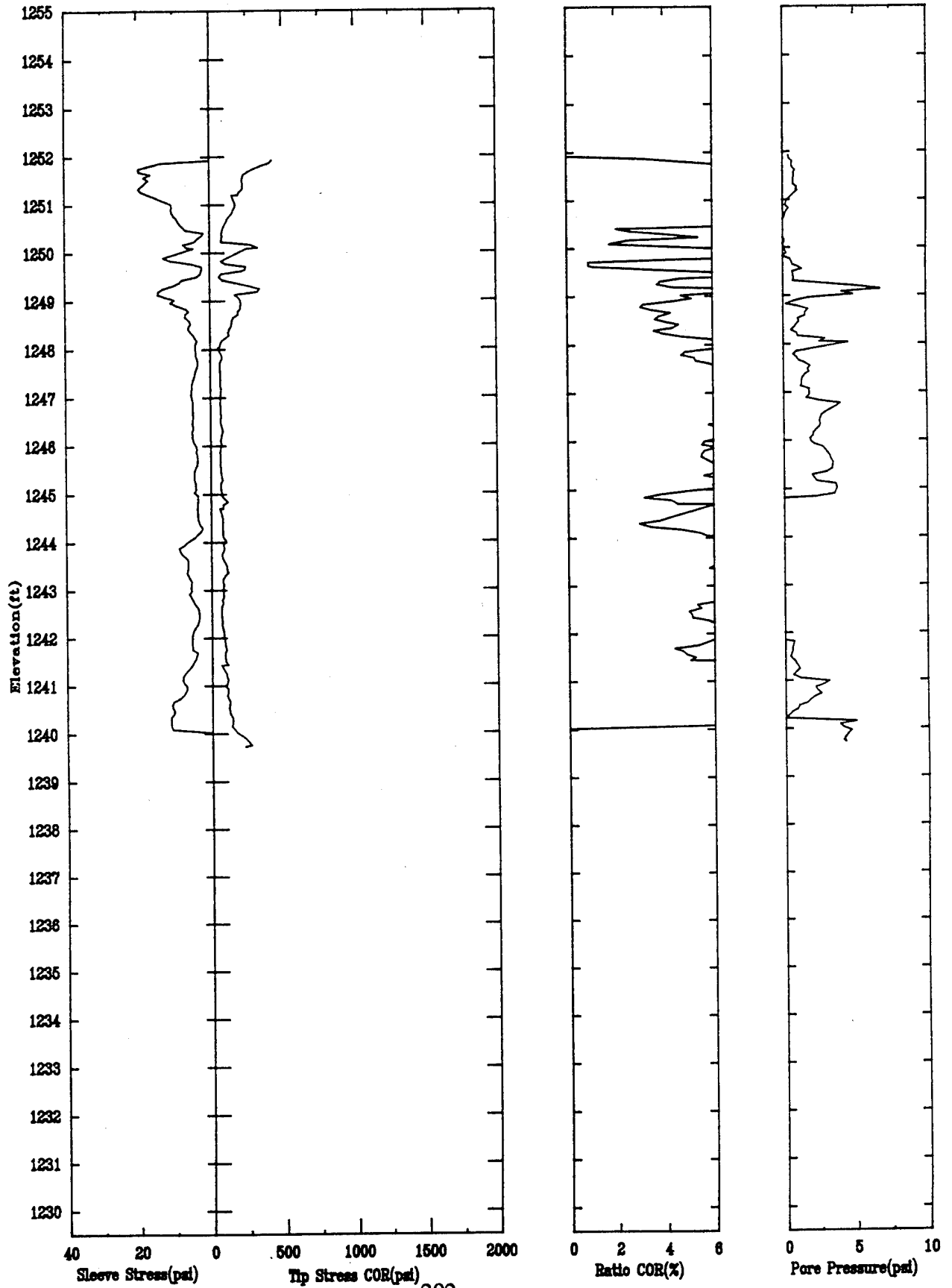
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150661.

East 2177751.

Elevation 1252.1



LF4-02

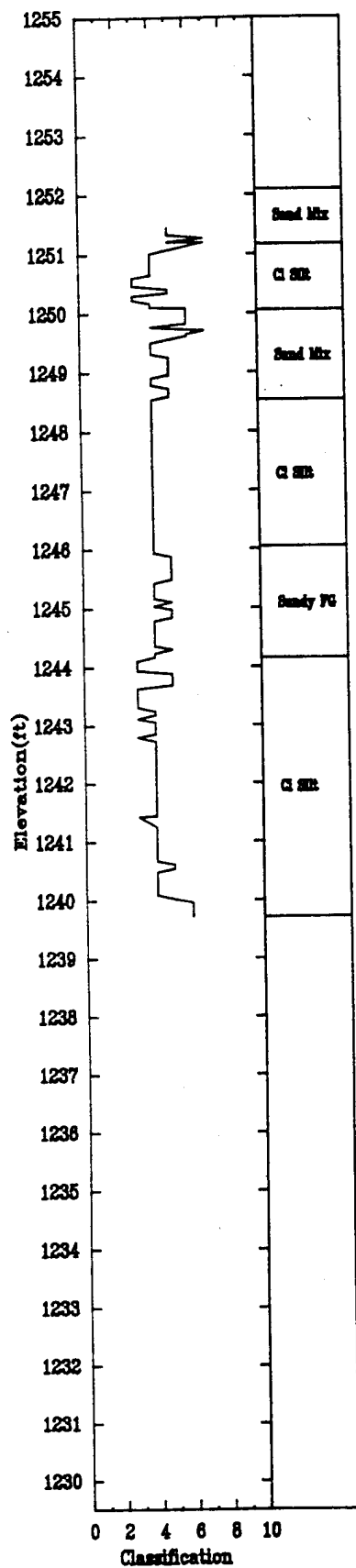
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150661.

East 2177751.

Elevation 1252.1



LF4-03

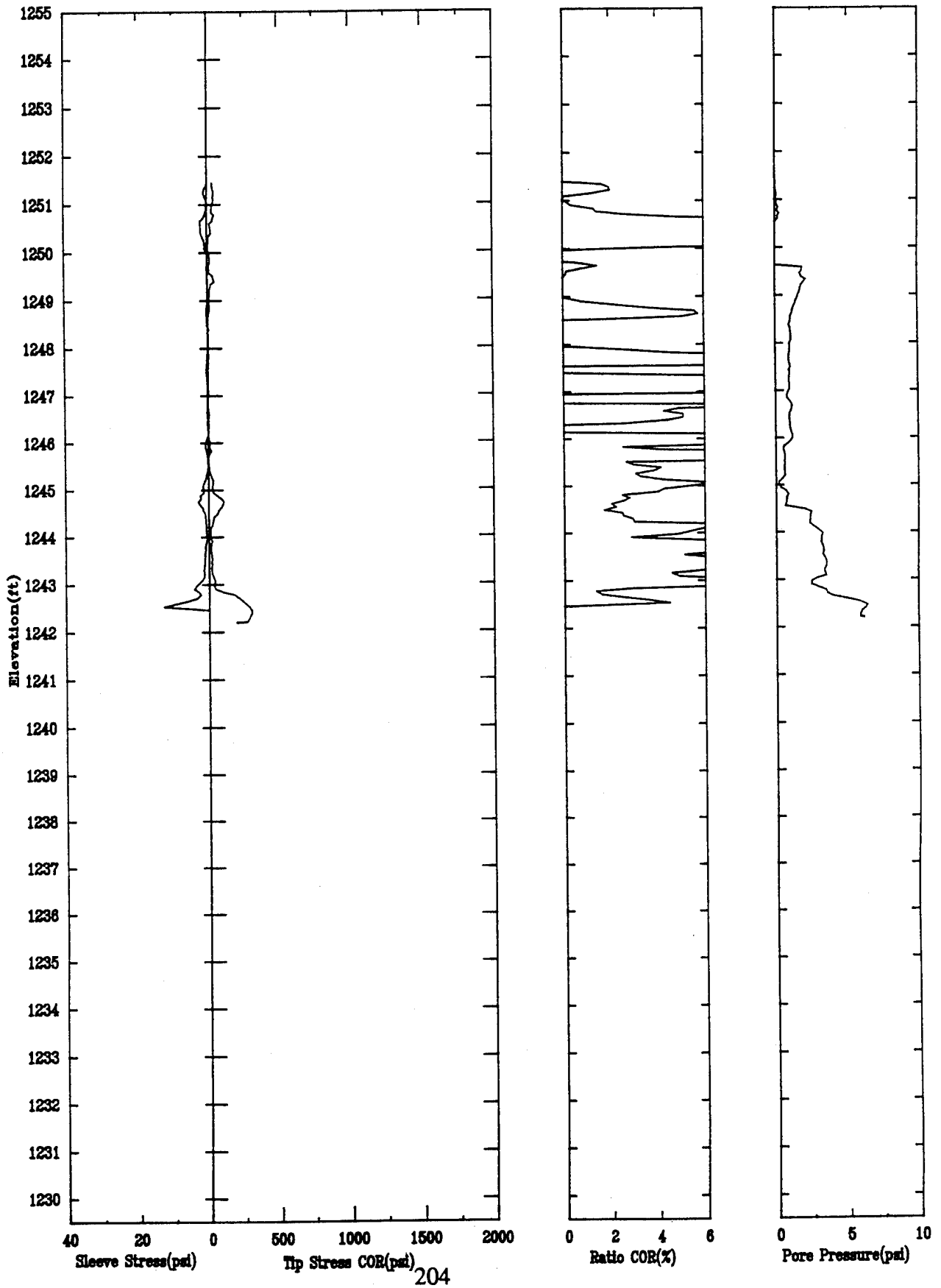
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150665.

East 2177857.

Elevation 1251.6



LF4-03

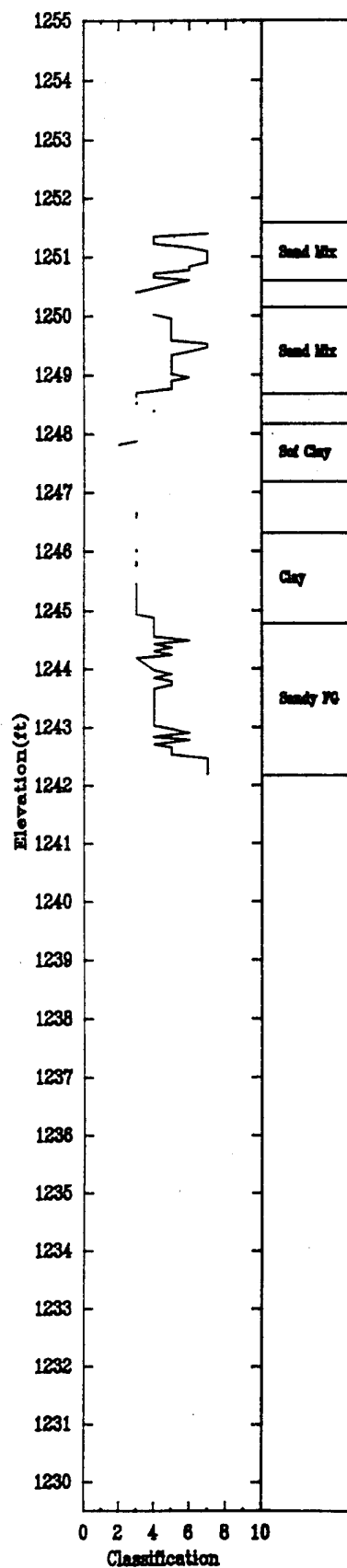
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150665.

East 2177857.

Elevation 1251.6



LF4-04

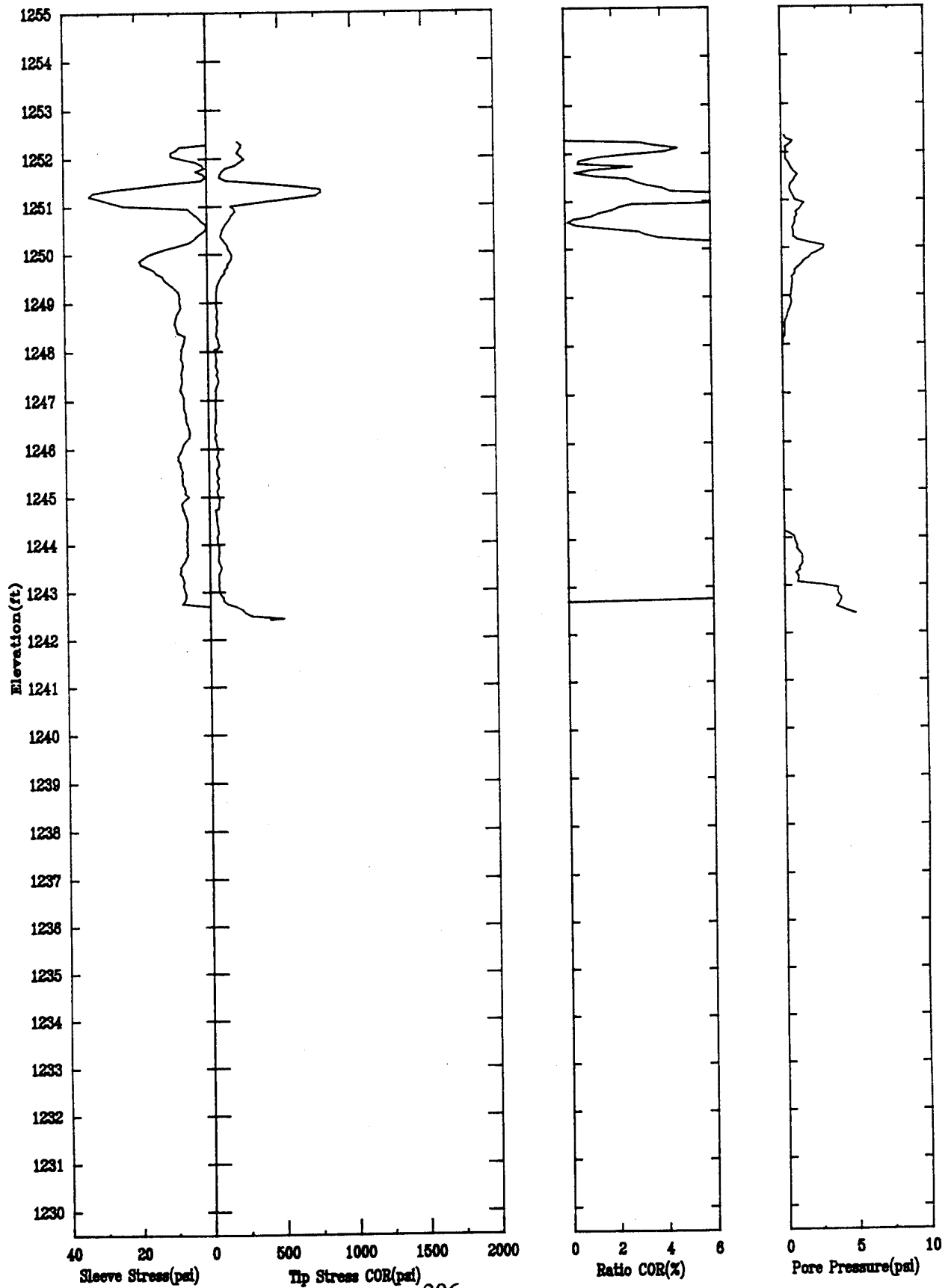
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150540.

East 2177876.

Elevation 1252.5



LF4-04

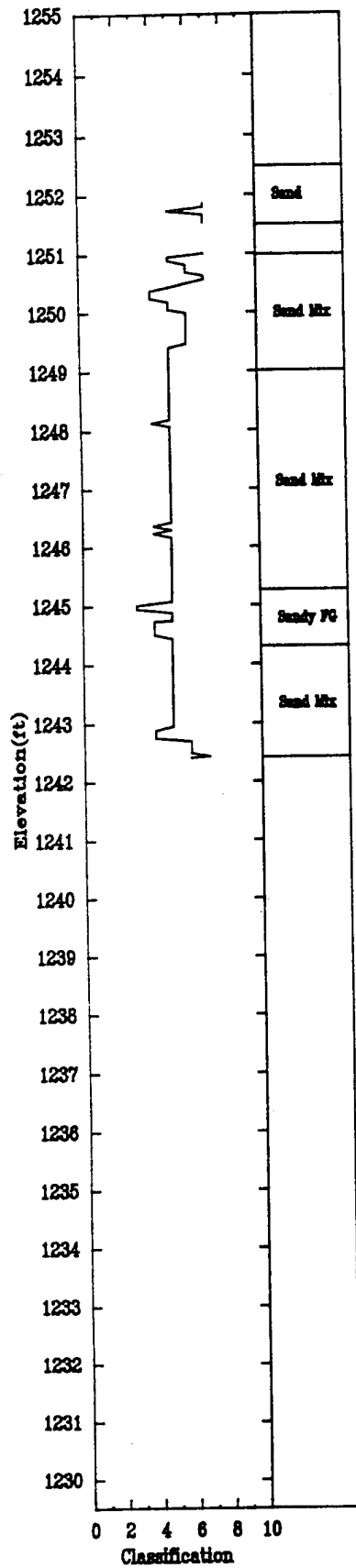
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150540.

East 2177876.

Elevation 1252.5



LF4-05

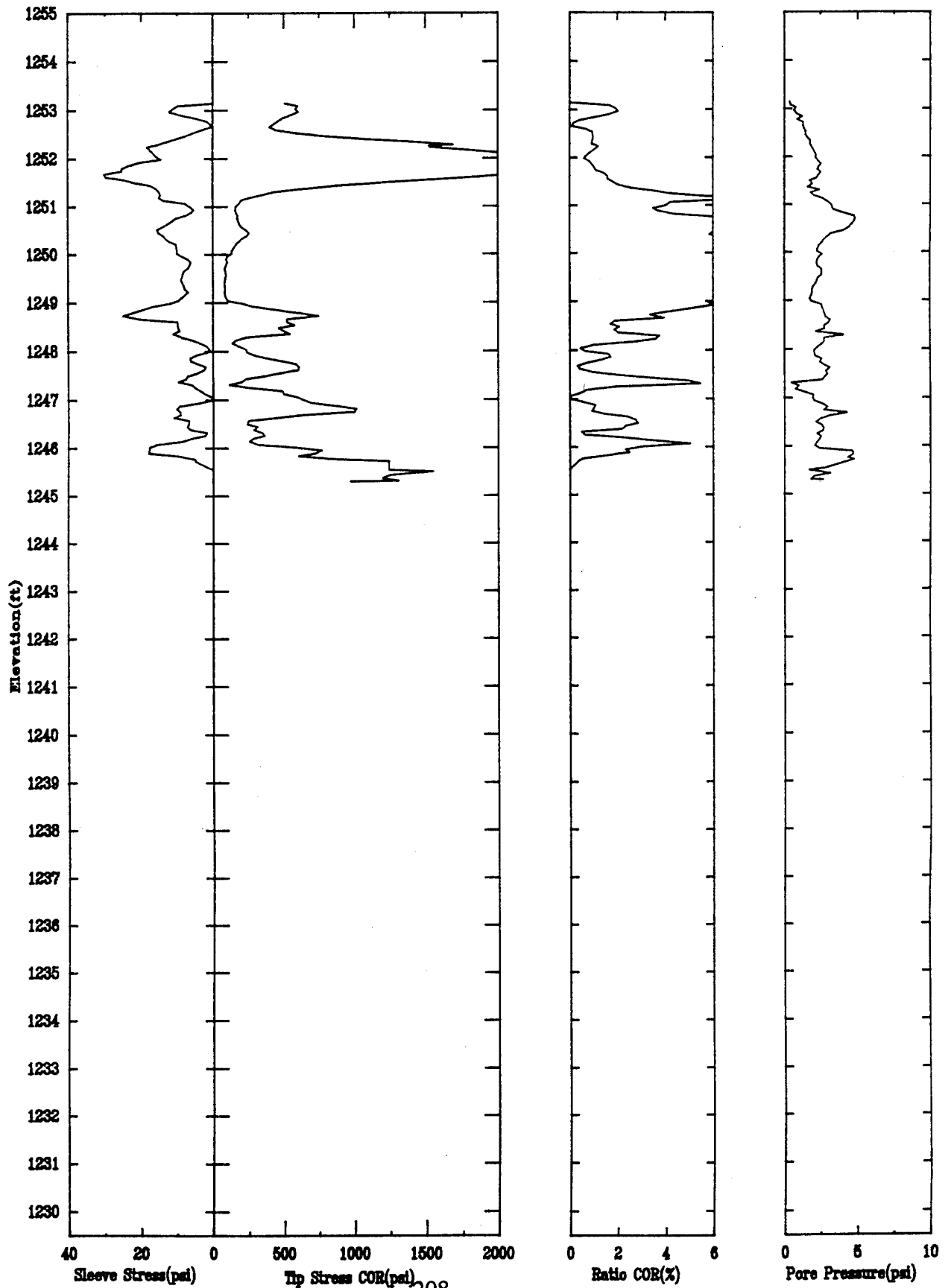
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150552.

East 2177757.

Elevation 1253.3



LF4-05

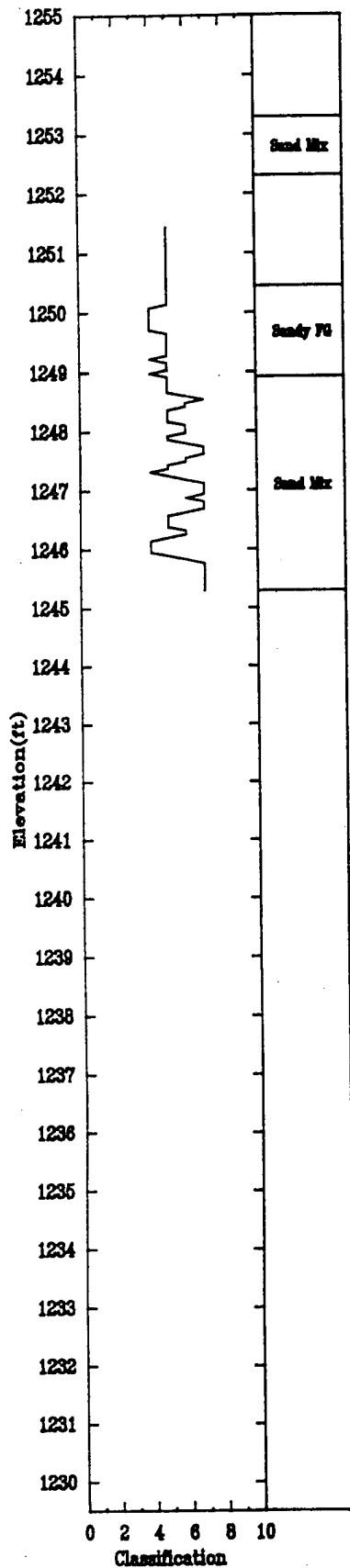
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150552.

East 2177757.

Elevation 1253.3



LF4-06

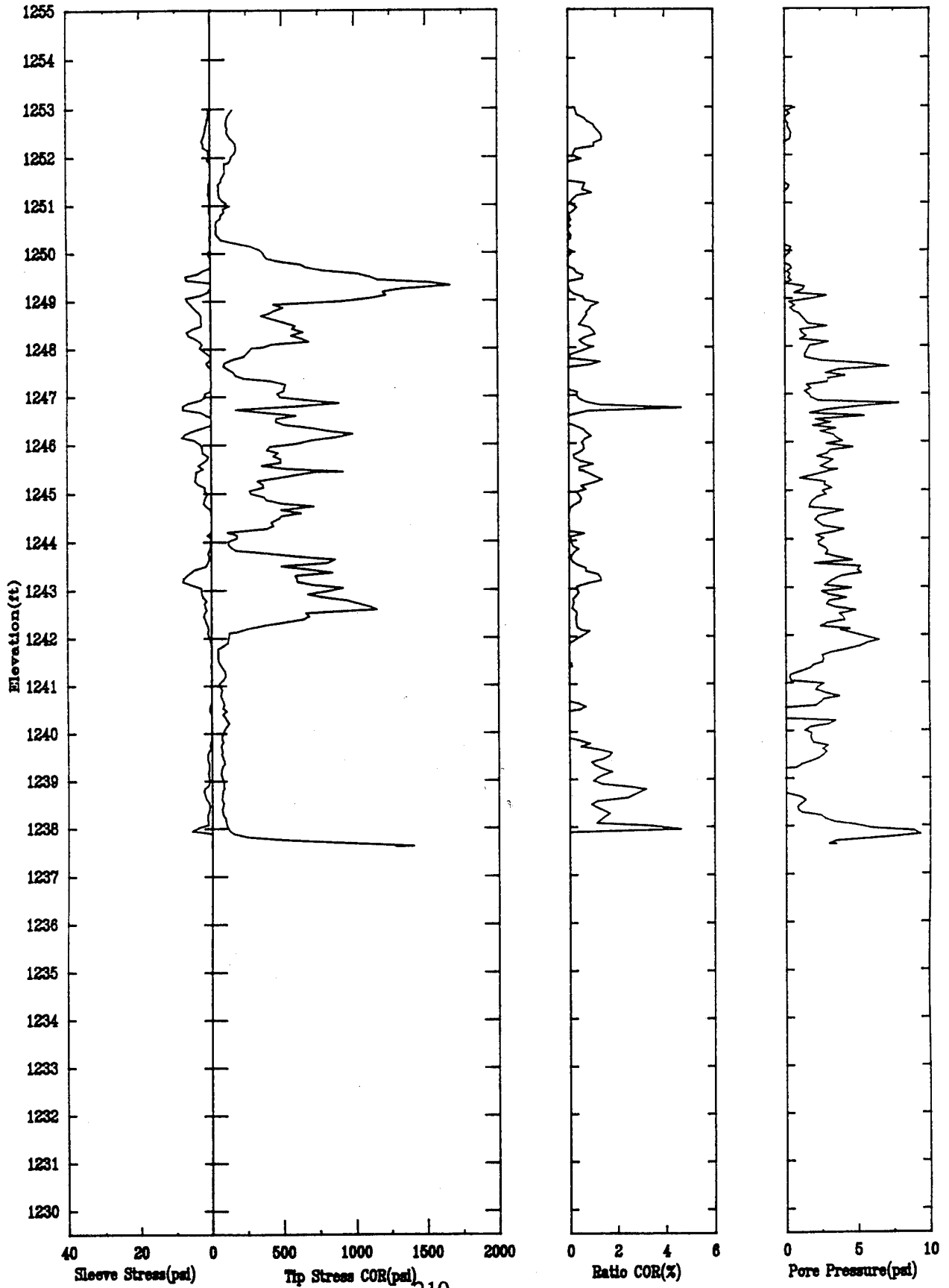
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150574.

East 2177652.

Elevation 1253.2



LF4-06

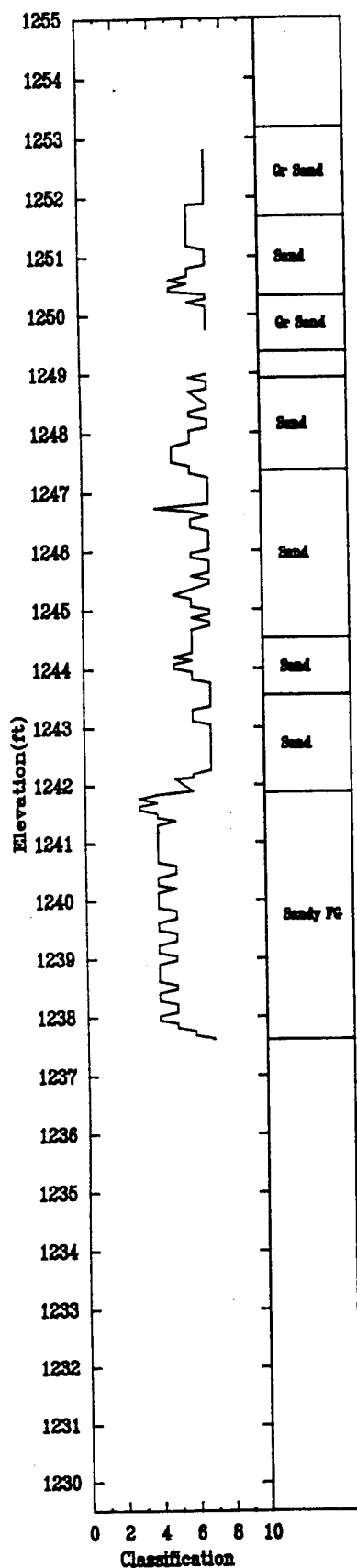
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150574.

East 2177652.

Elevation 1253.2



LF4-07

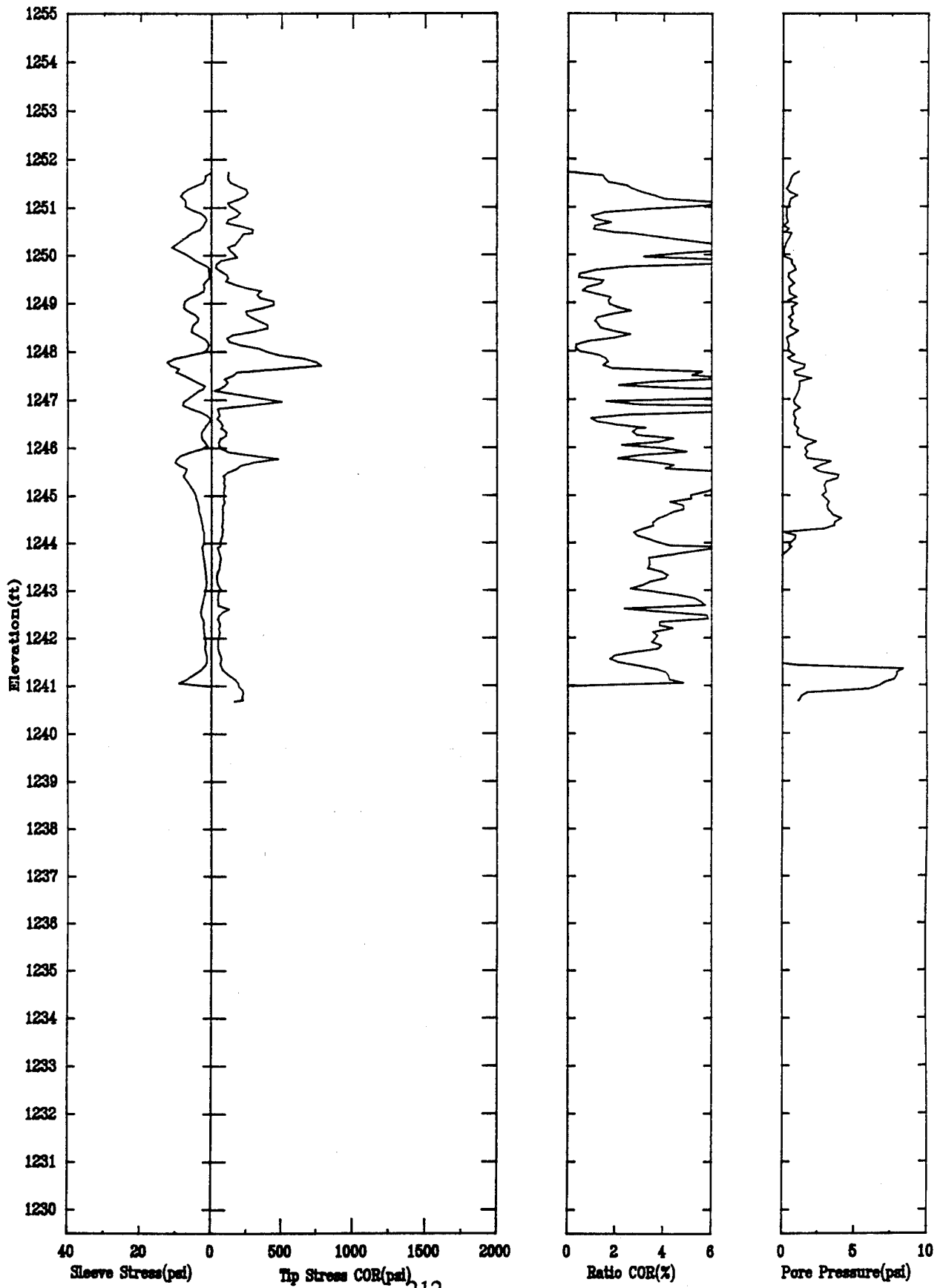
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150570.

East 2177556.

Elevation 1251.9



LF4-07

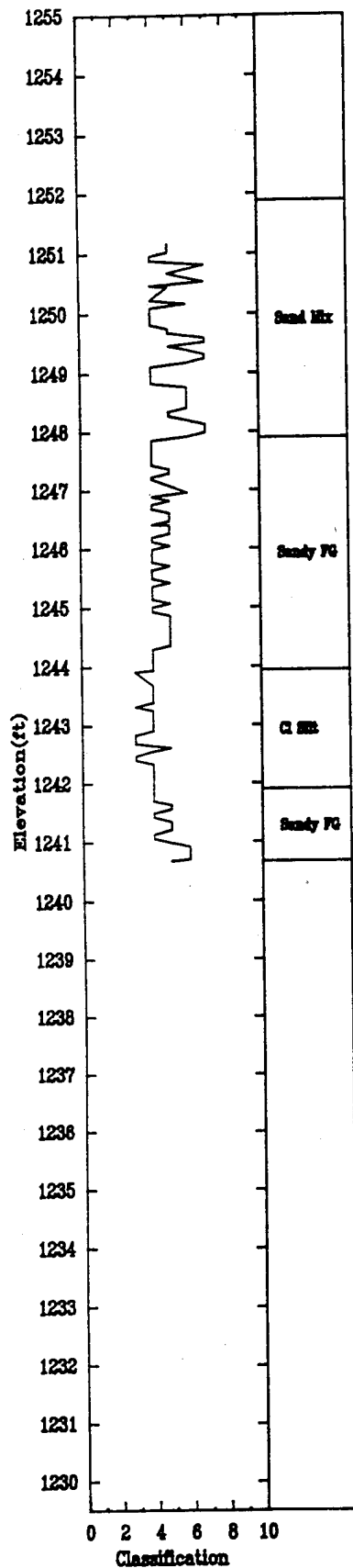
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150570.

East 2177556.

Elevation 1251.9



LF4-08

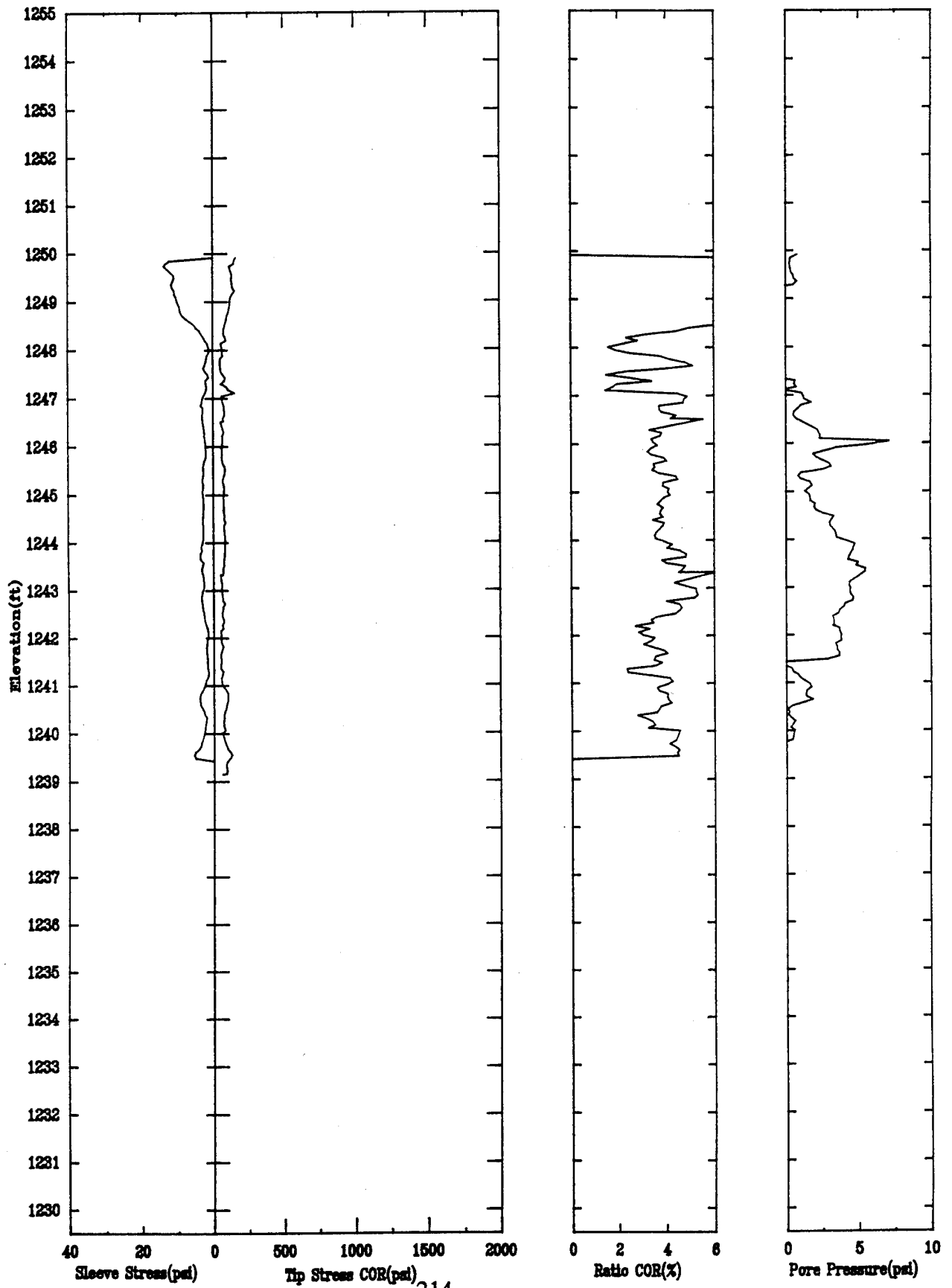
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150562.

East 2177459.

Elevation 1250.1



LF4-08

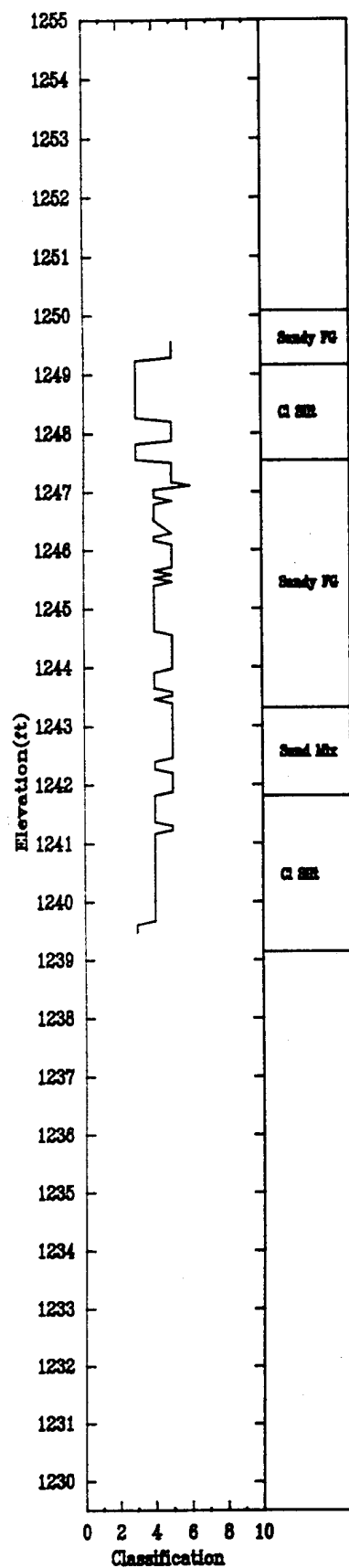
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150562.

East 2177459.

Elevation 1250.1



LF4-09

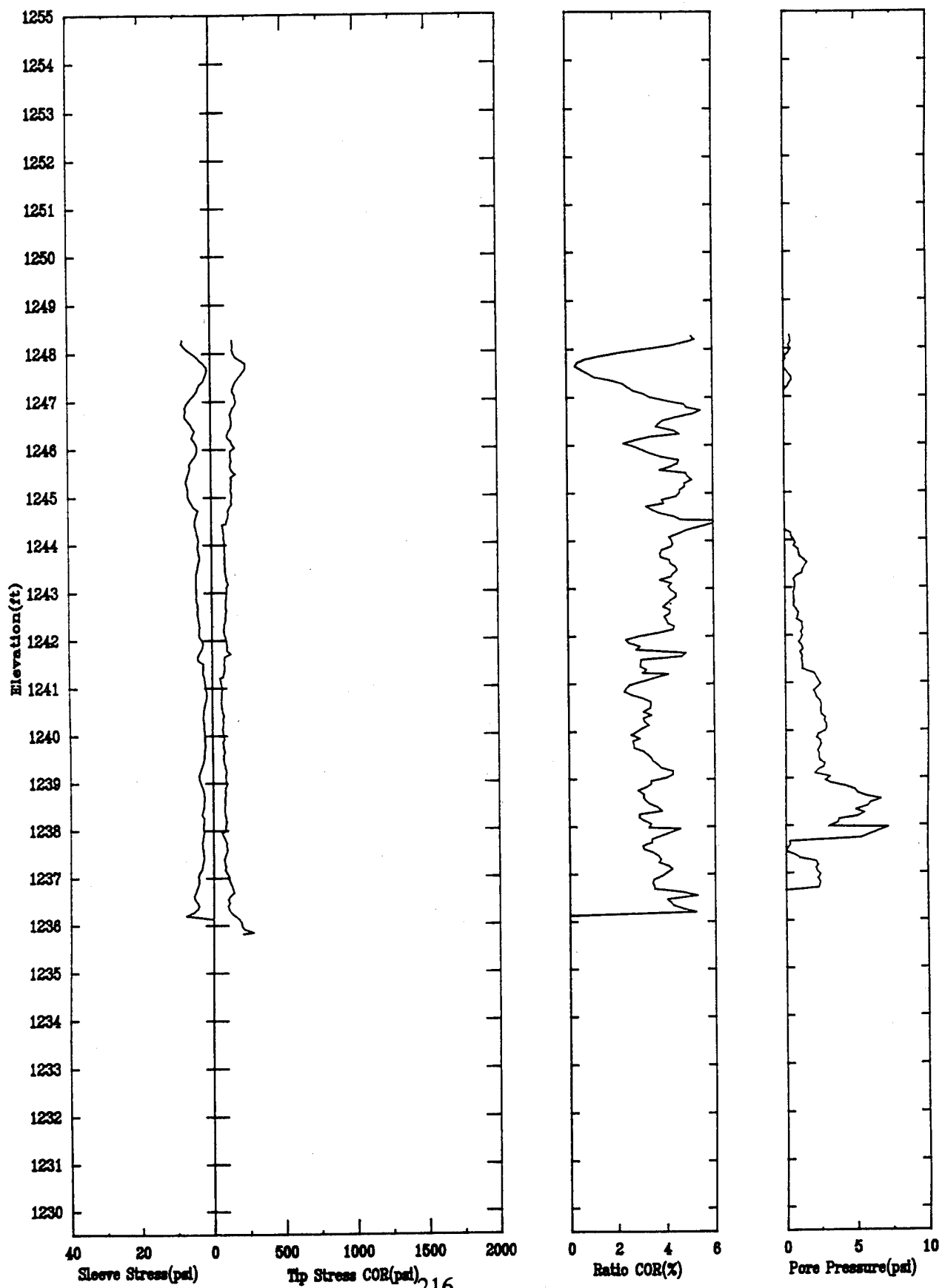
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150556.

East 2177364.

Elevation 1248.5



LF4-09

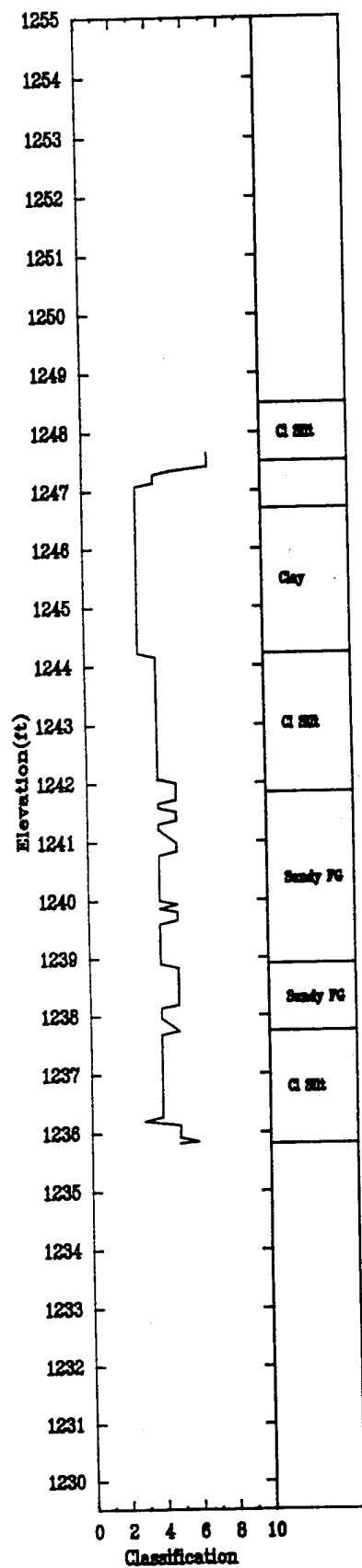
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150556.

East 2177364.

Elevation 1248.5



LF4-10

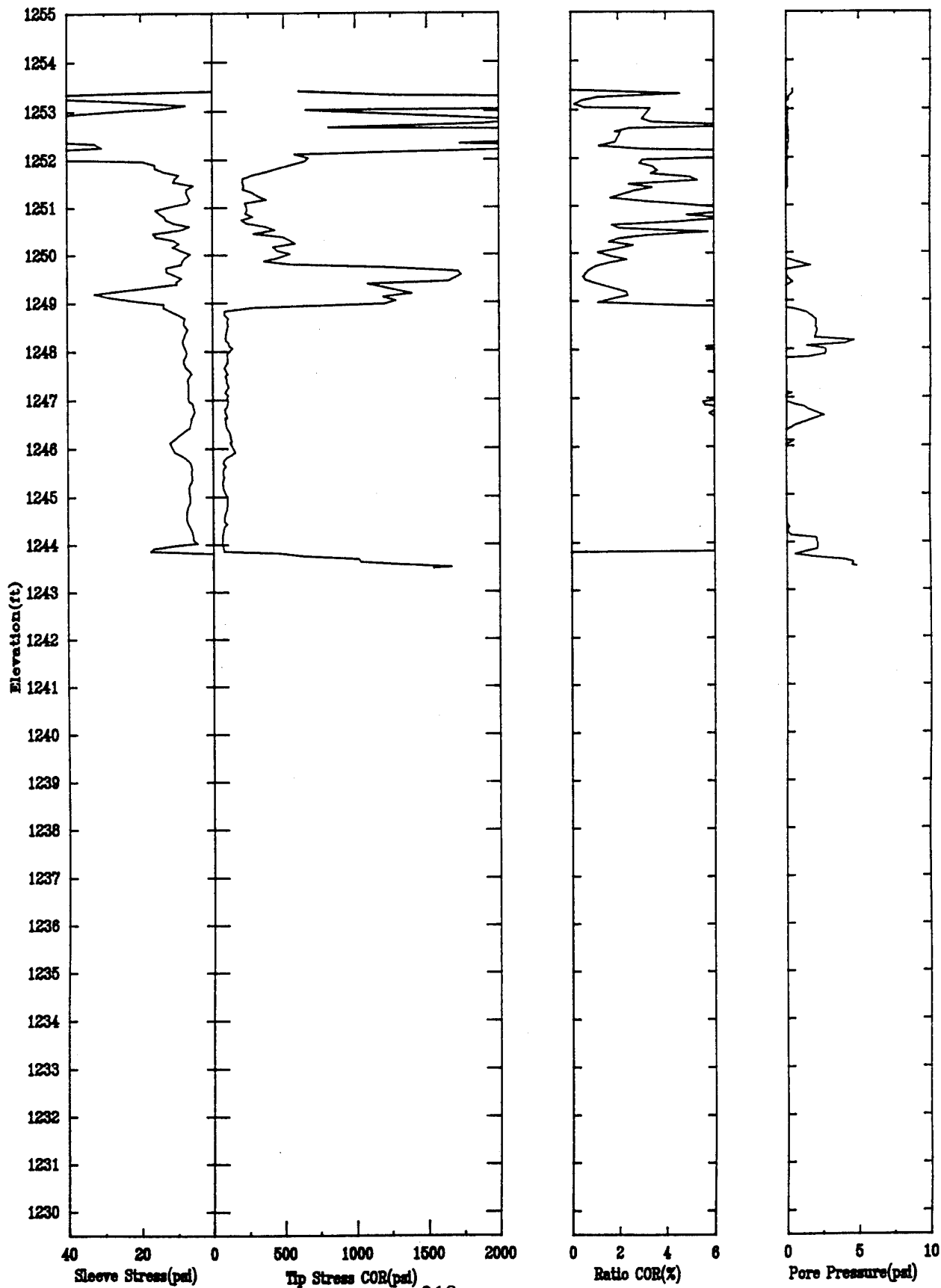
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150454.

East 2177738.

Elevation 1253.6



LF4-10

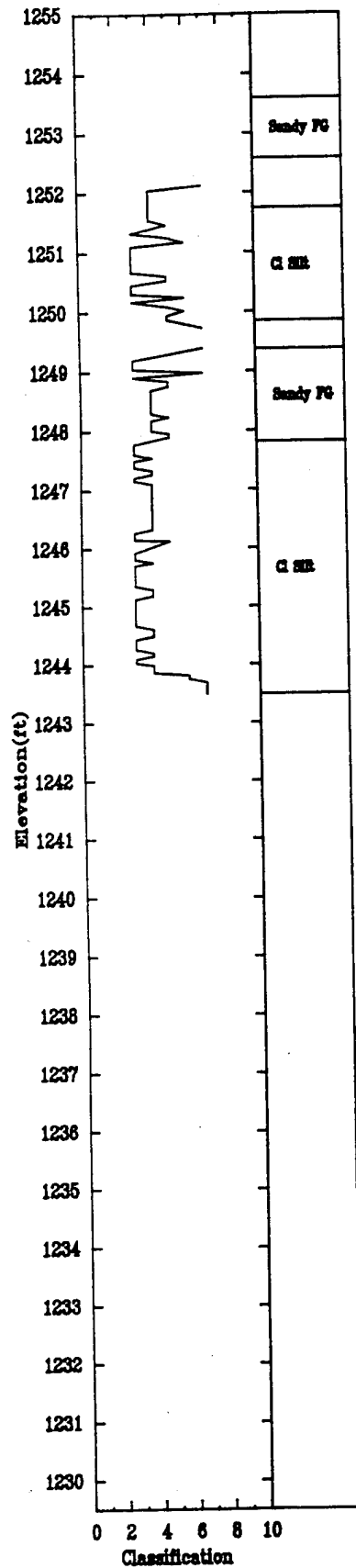
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150454.

East 2177738.

Elevation 1253.6



LF4-11

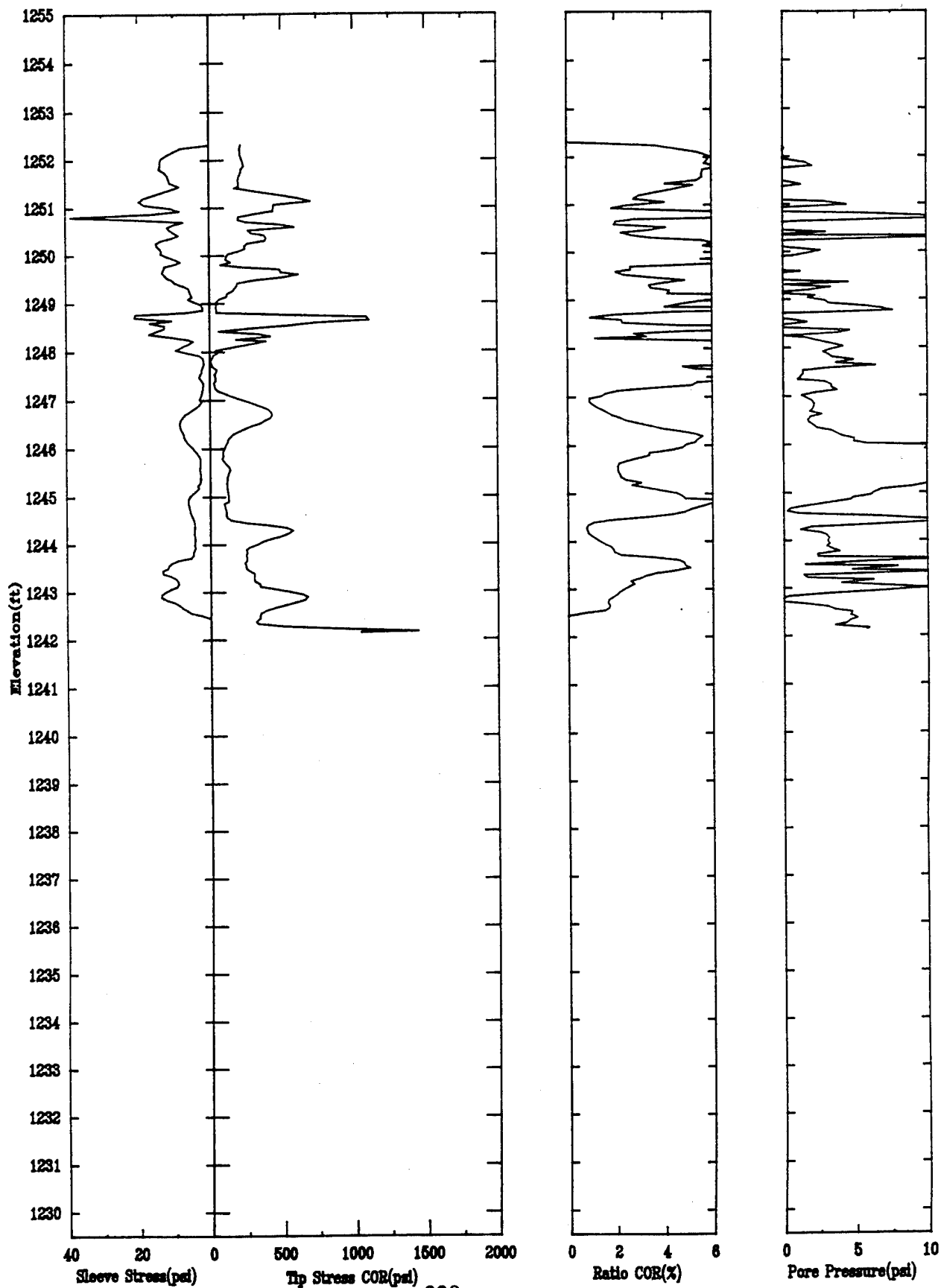
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150443.

East 2177857.

Elevation 1252.5



LF4-11

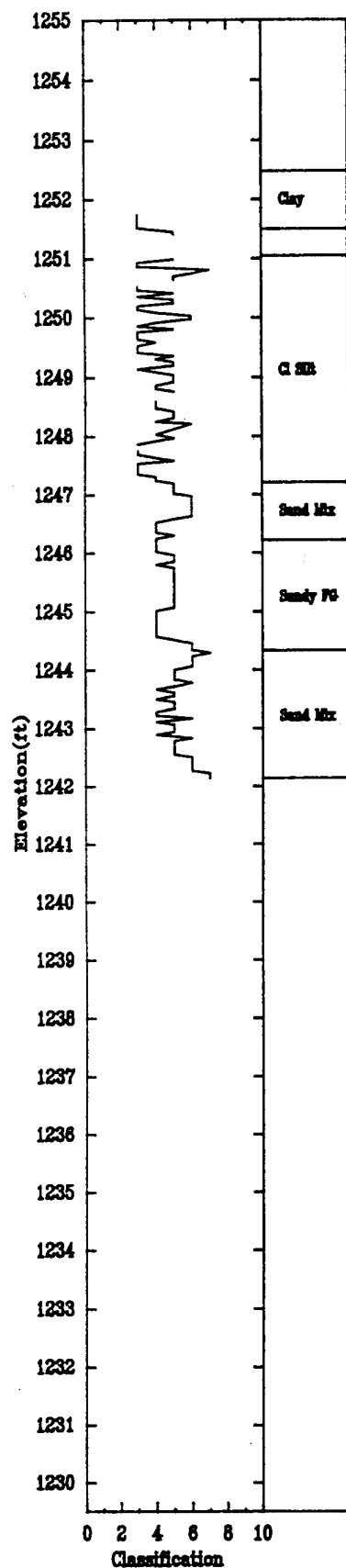
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150443.

East 2177857.

Elevation 1252.5



LF4-12

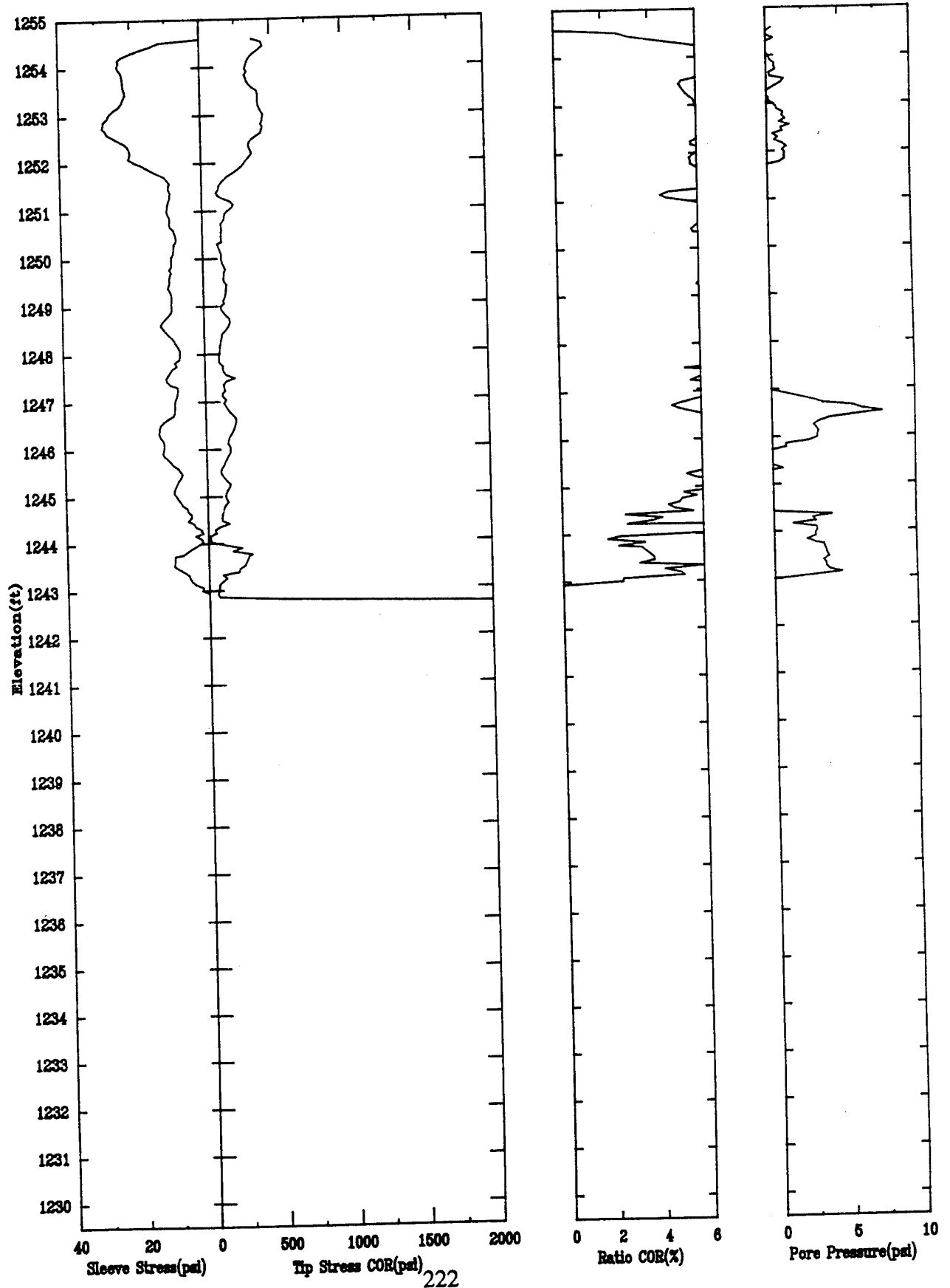
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150378.

East 2177727.

Elevation 1254.8



LF4-12

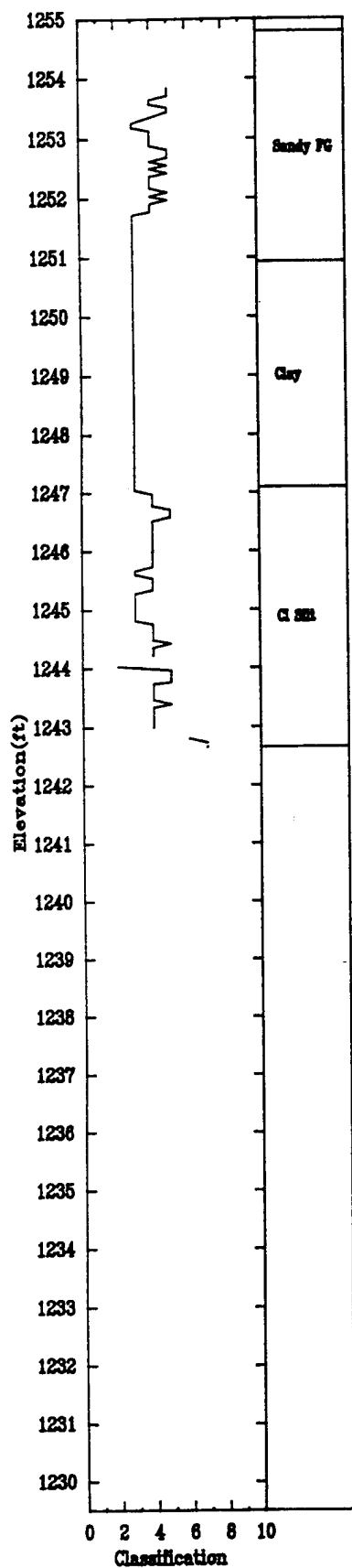
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150378.

East 2177727.

Elevation 1254.8



LF4-13

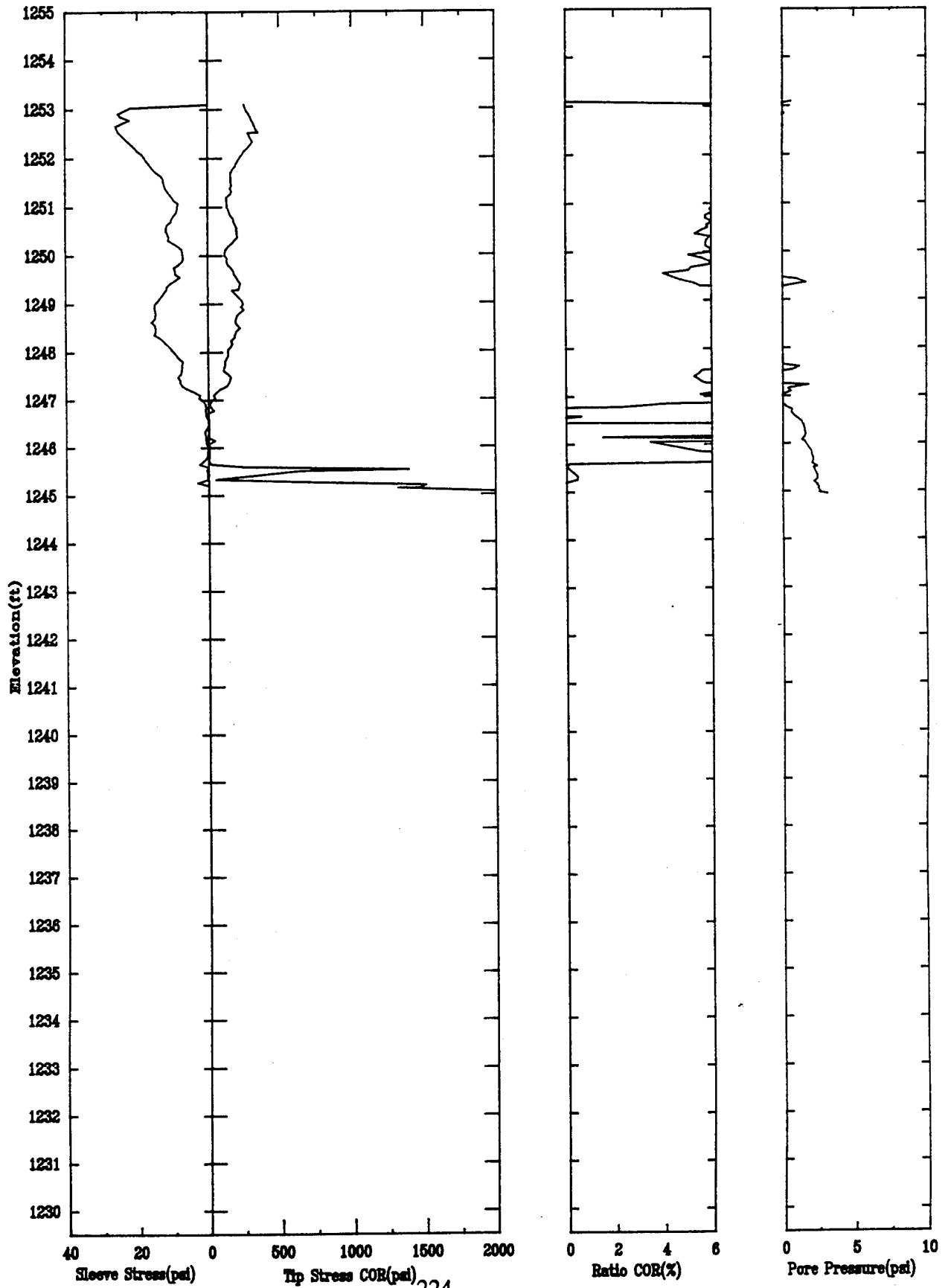
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150282.

East 2177717.

Elevation 1253.3



LF4-13

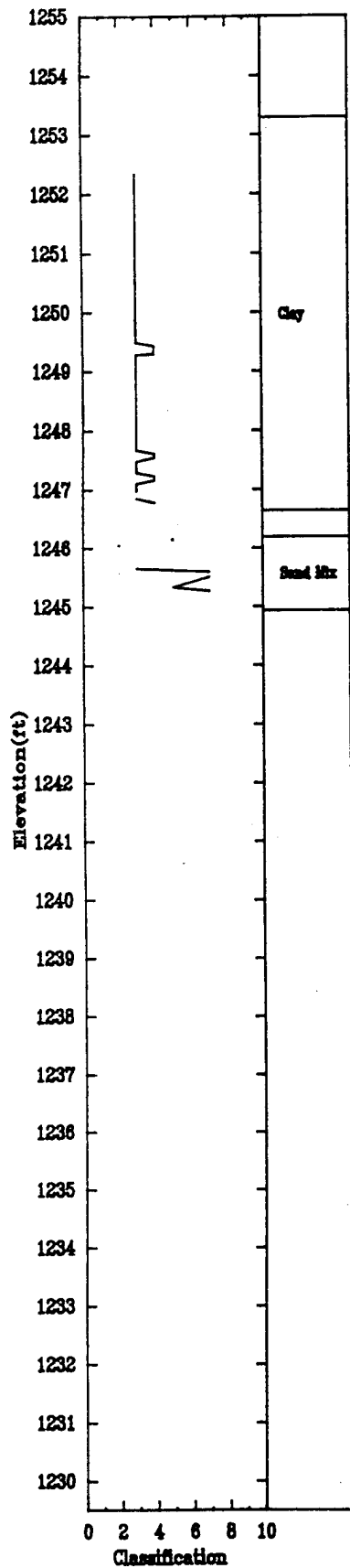
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150282.

East 2177717.

Elevation 1253.3



LF4-14

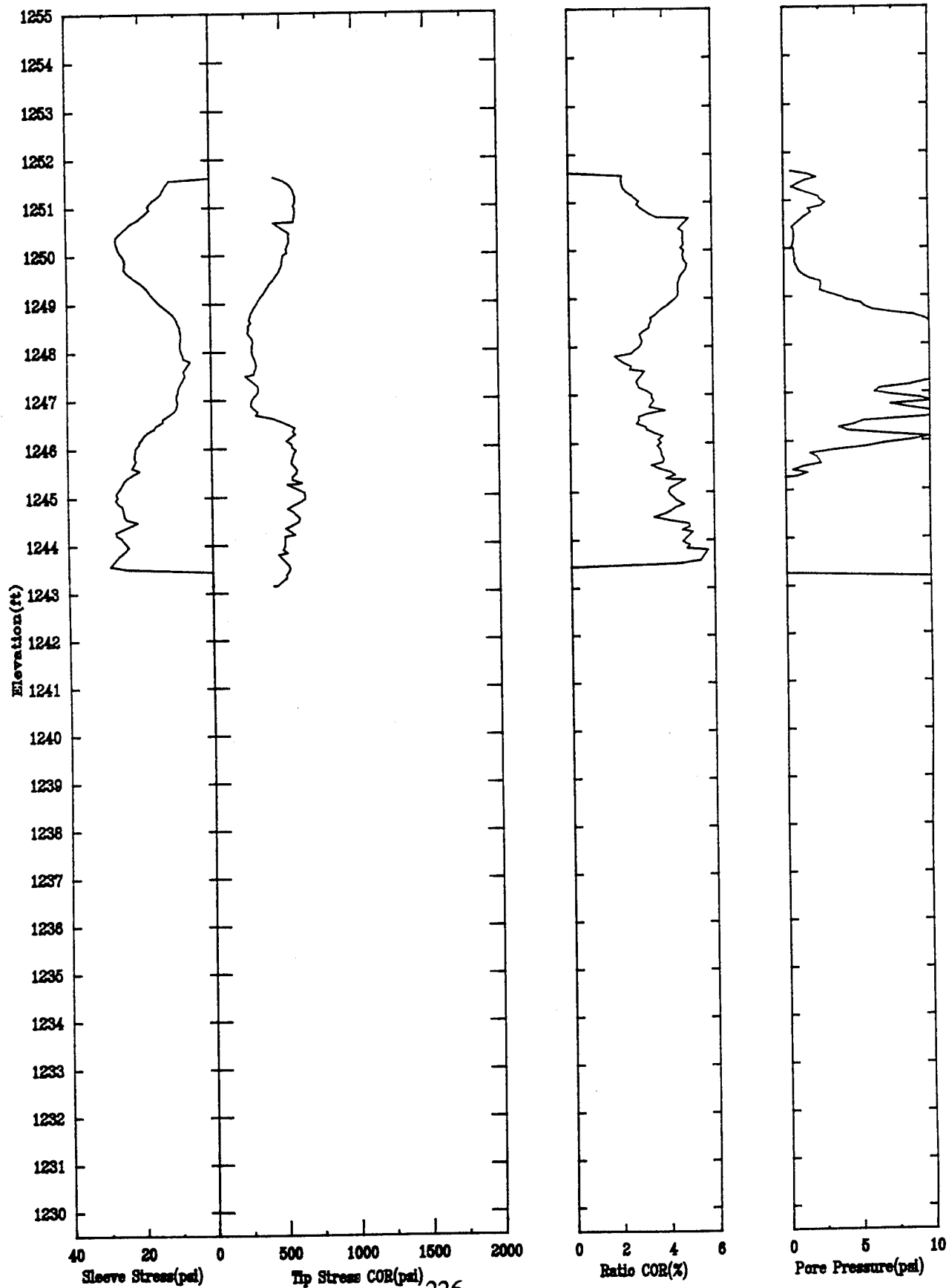
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150196.

East 2177706.

Elevation 1251.8



LF4-14

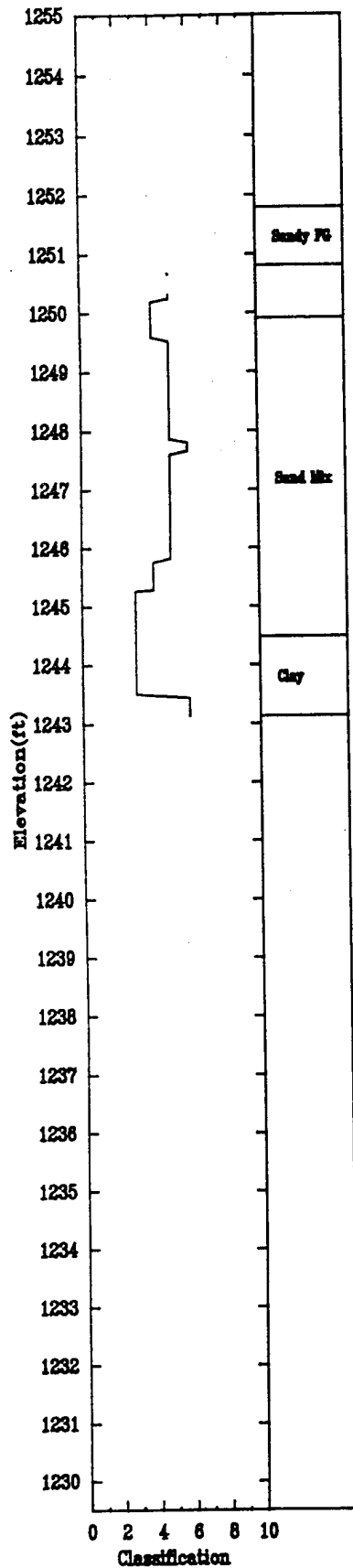
APPLIED RESEARCH ASSOCIATES, INC.

09/26/92

North 150196.

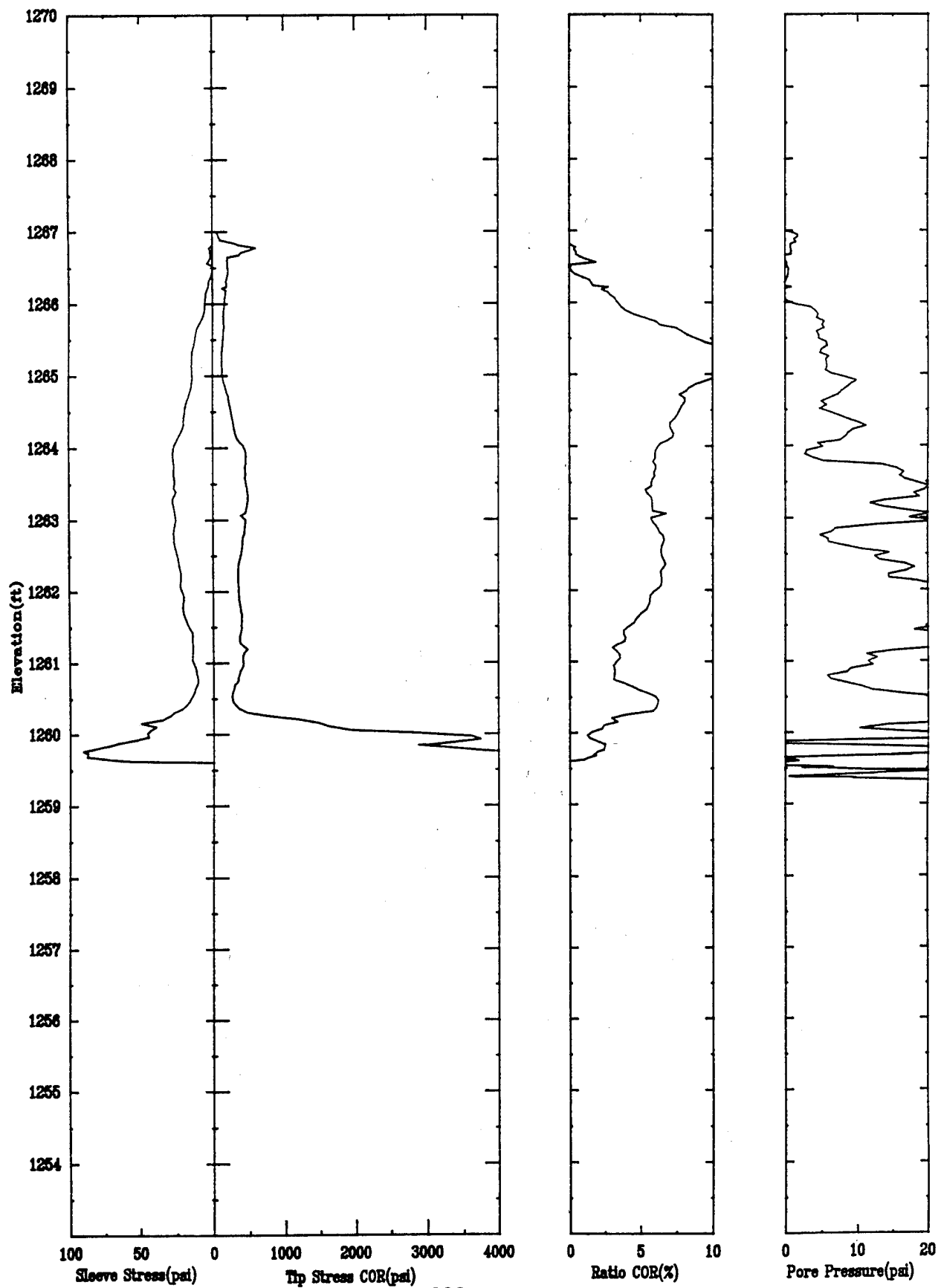
East 2177706.

Elevation 1251.8



APPENDIX G

LIF-CPT PROFILES FROM THE OFFBASE AREA



OFB-03

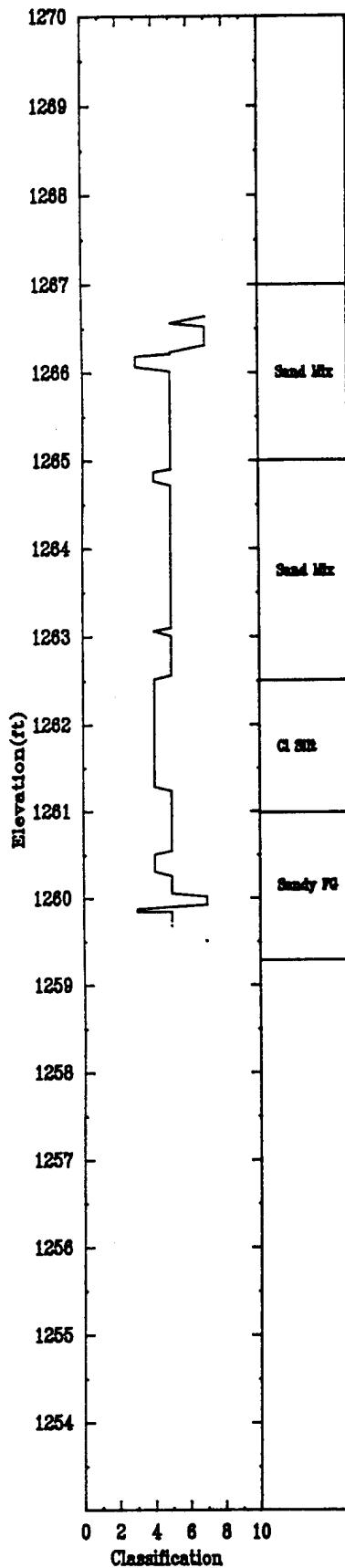
APPLIED RESEARCH ASSOCIATES, INC.

10/03/92

North 156521.

East 2185155.

Elevation 1267.0



OFB-04

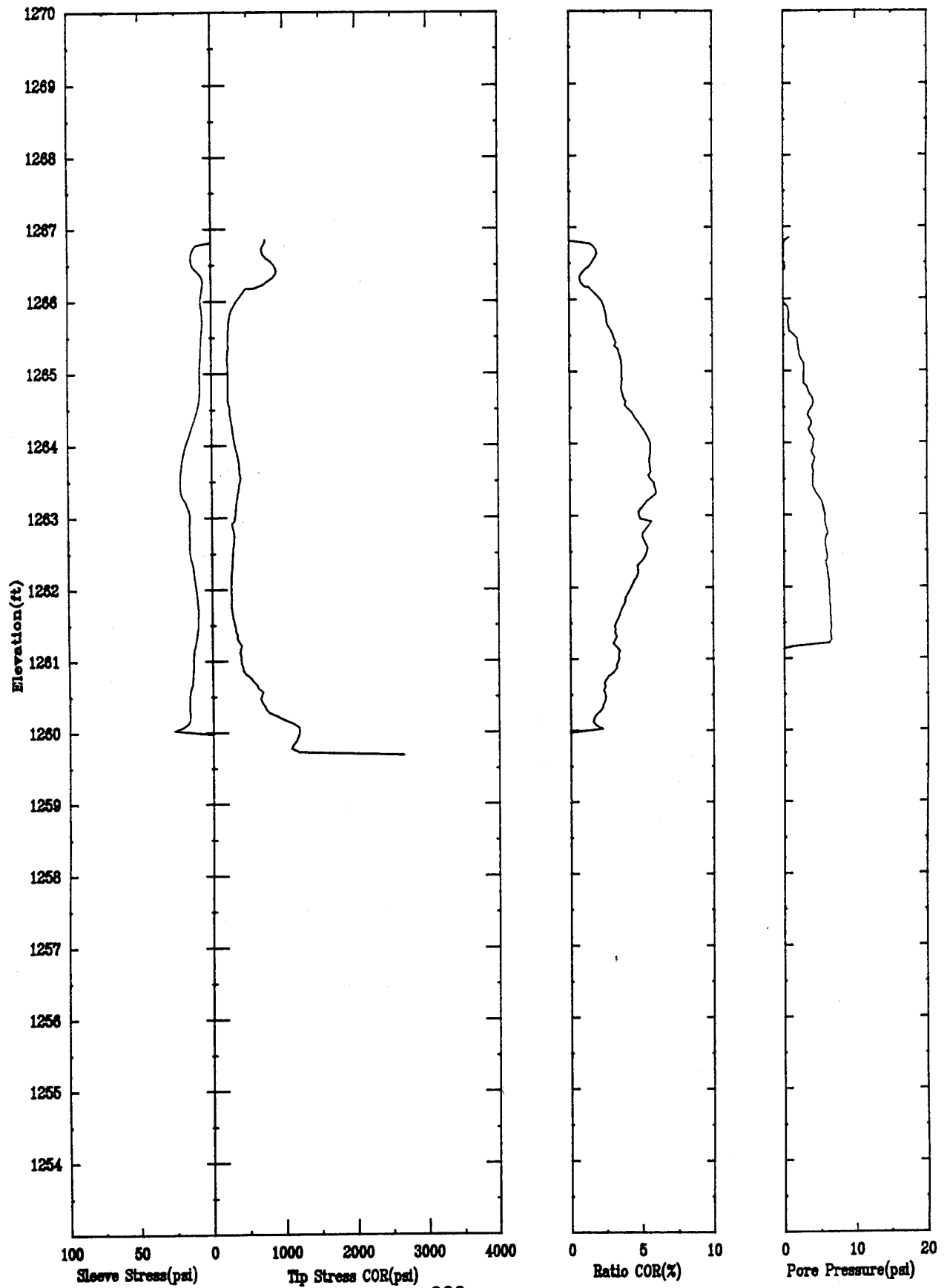
APPLIED RESEARCH ASSOCIATES, INC.

10/03/92

North 156453.

East 2185853.

Elevation 1267.0



OFB-04

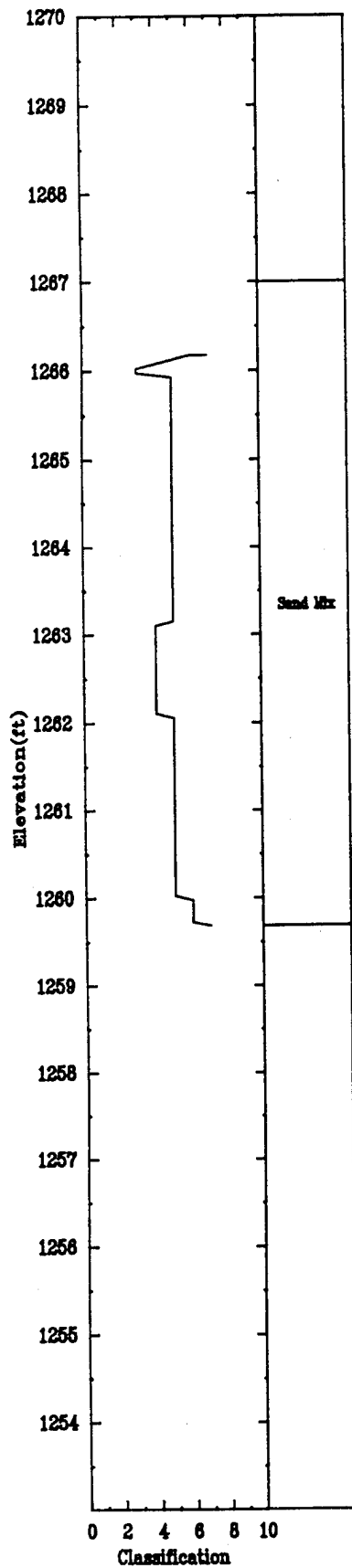
APPLIED RESEARCH ASSOCIATES, INC.

10/03/92

North 156453.

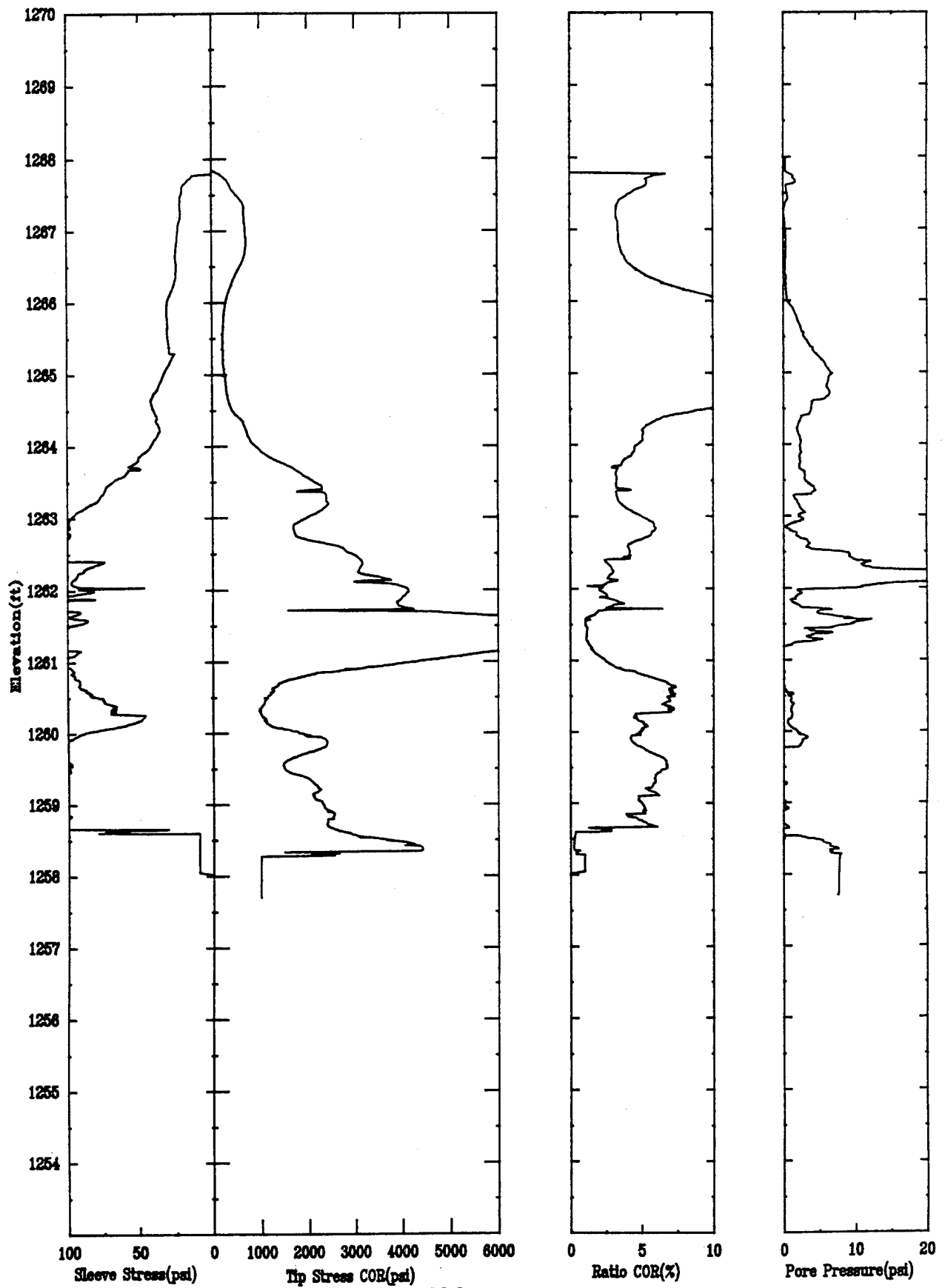
East 2185853.

Elevation 1267.0



APPENDIX H

LIF-CPT PROFILES FROM THE BACKGROUND AREA



BGA-01

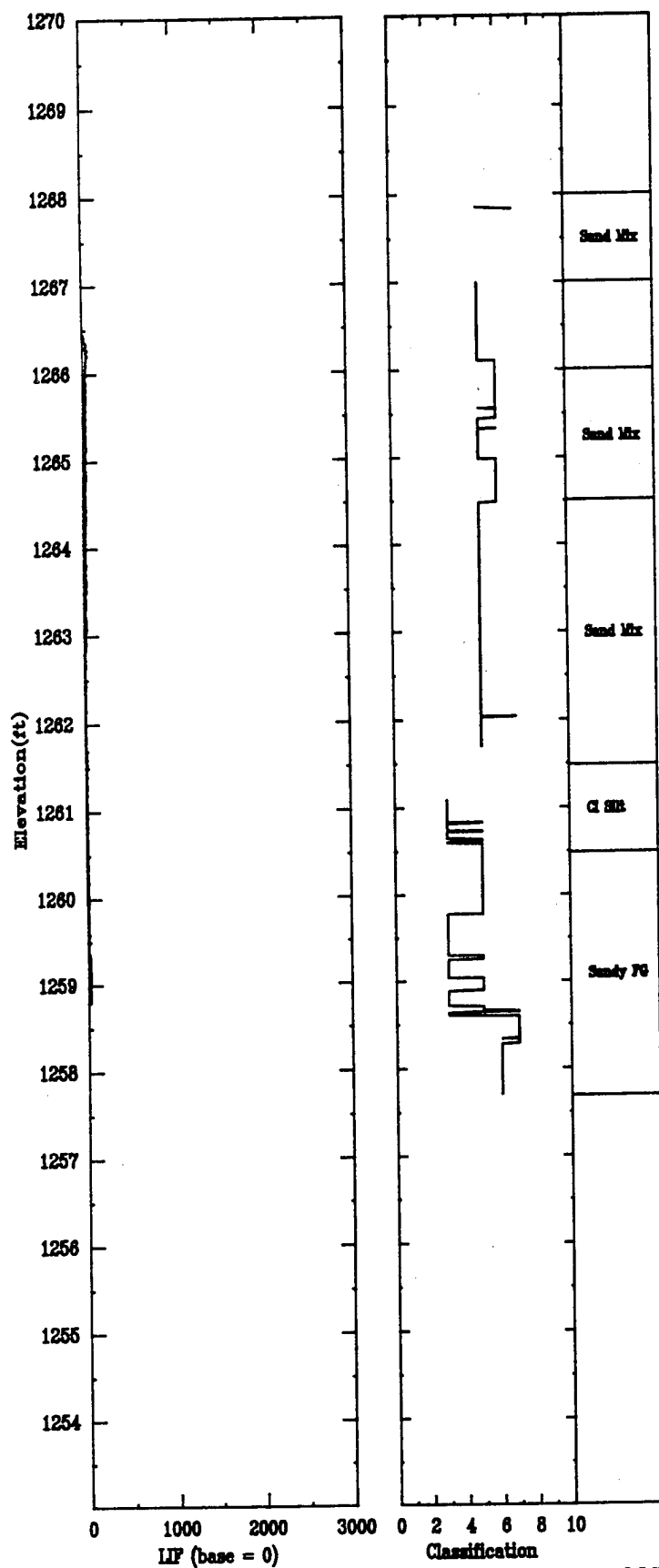
APPLIED RESEARCH ASSOCIATES, INC.

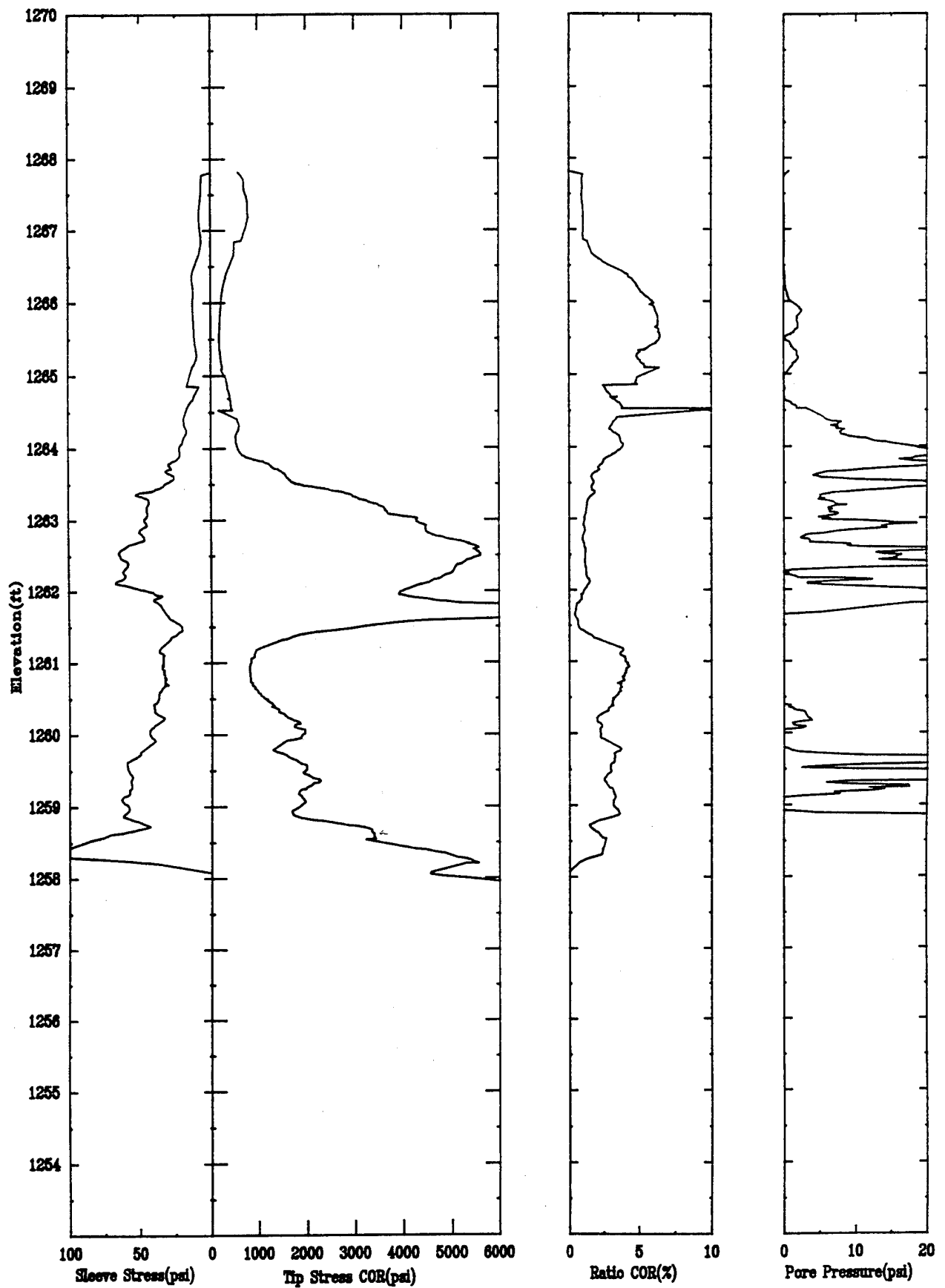
09/01/92

North 153953

East 2187389

Elevation 1268.0





BGA-02

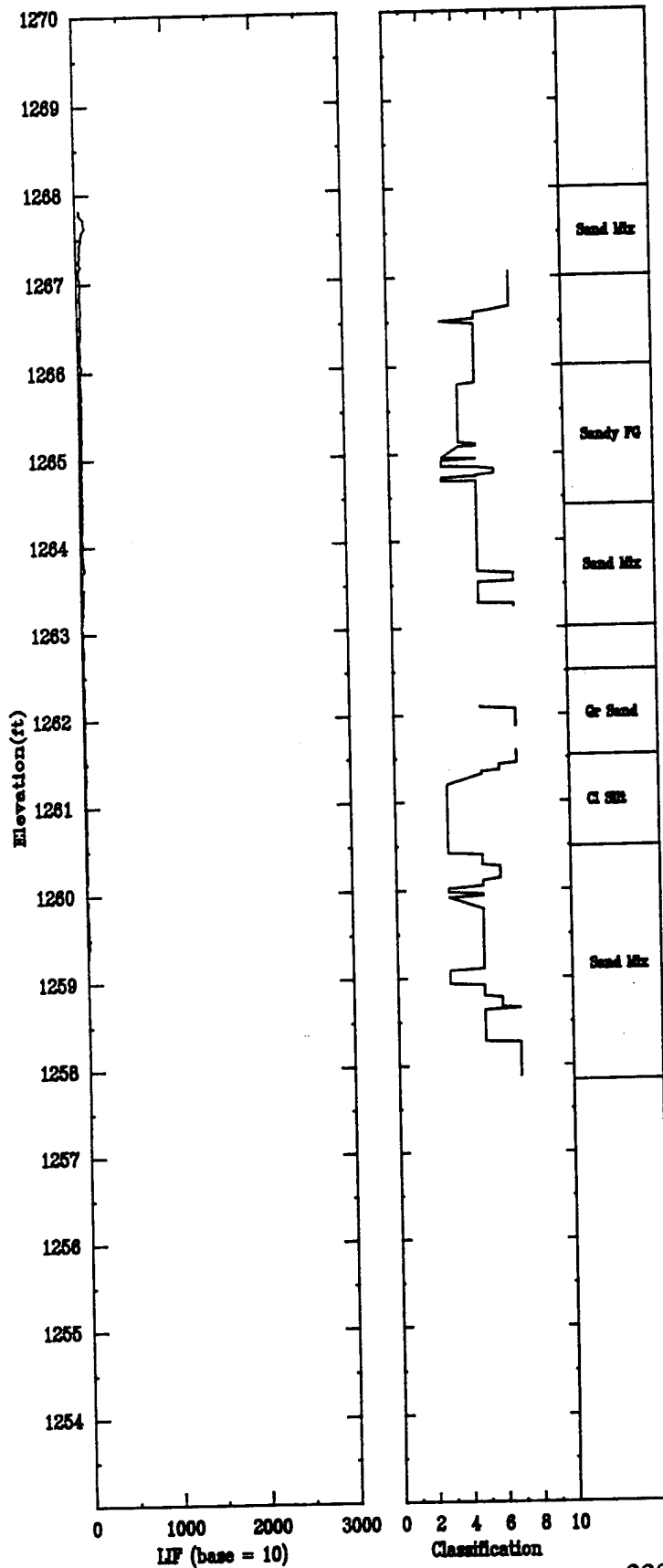
APPLIED RESEARCH ASSOCIATES, INC.

09/01/92

North 153954

East 2187384

Elevation 1268.0



BGA-03

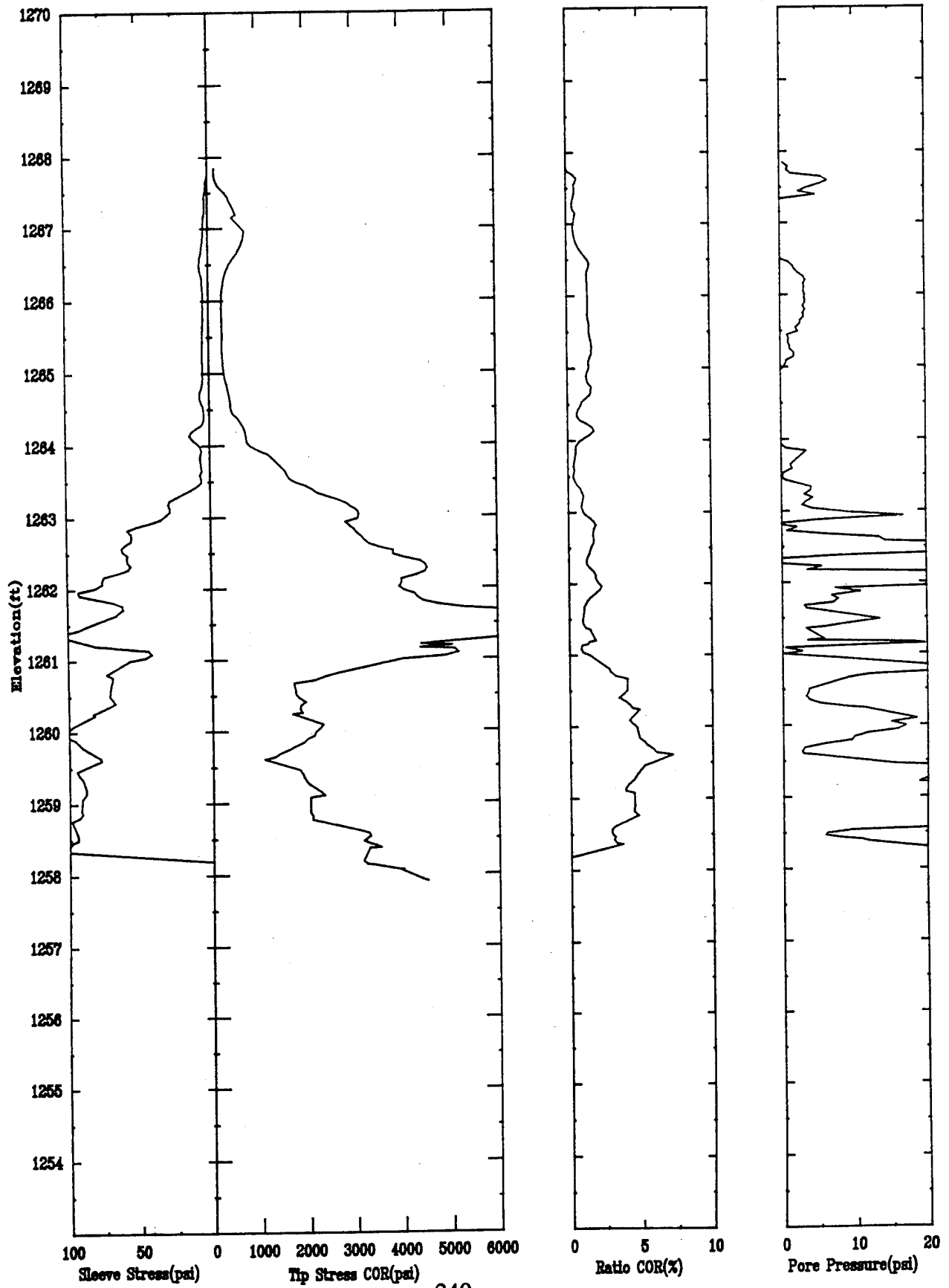
APPLIED RESEARCH ASSOCIATES, INC.

09/22/92

North 153952

East 2187386

Elevation 1268.0



BGA-03

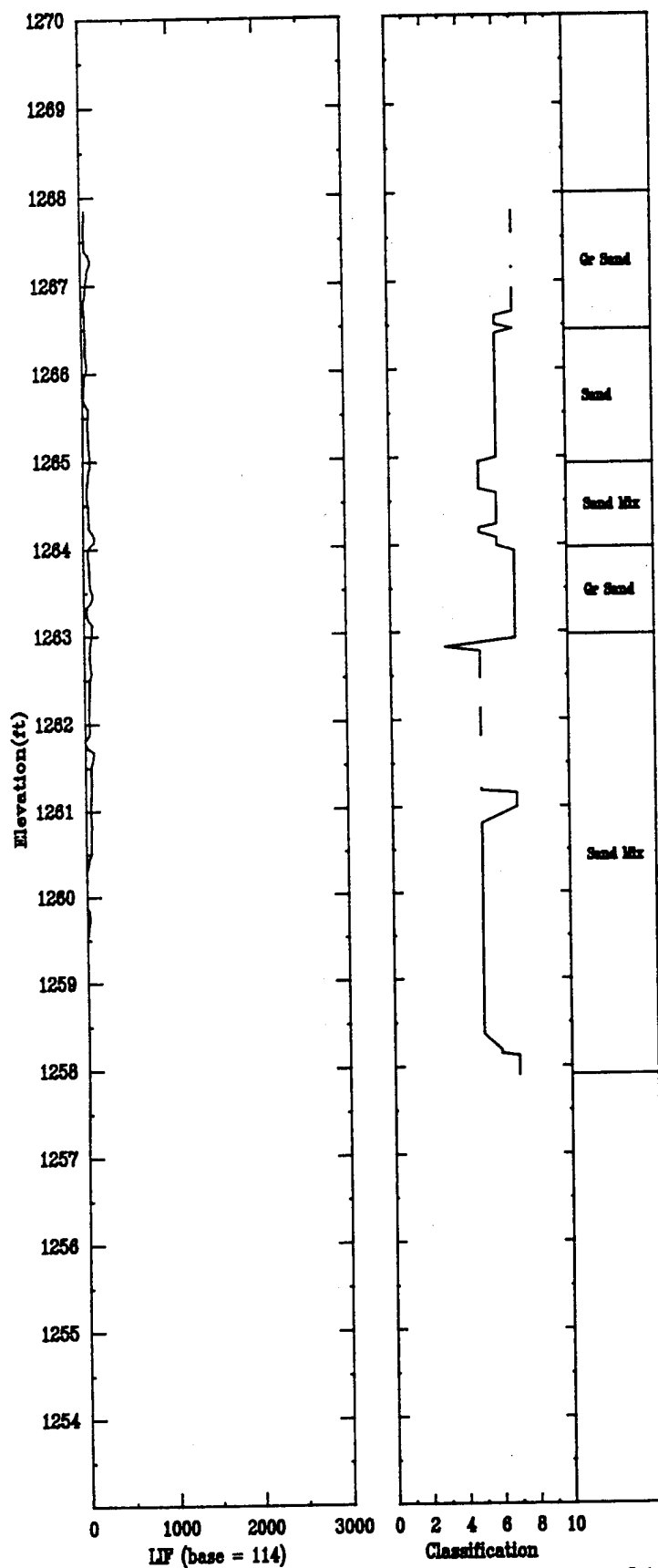
APPLIED RESEARCH ASSOCIATES, INC.

09/22/92

North 153952

East 2187386

Elevation 1268.0



BGA-04

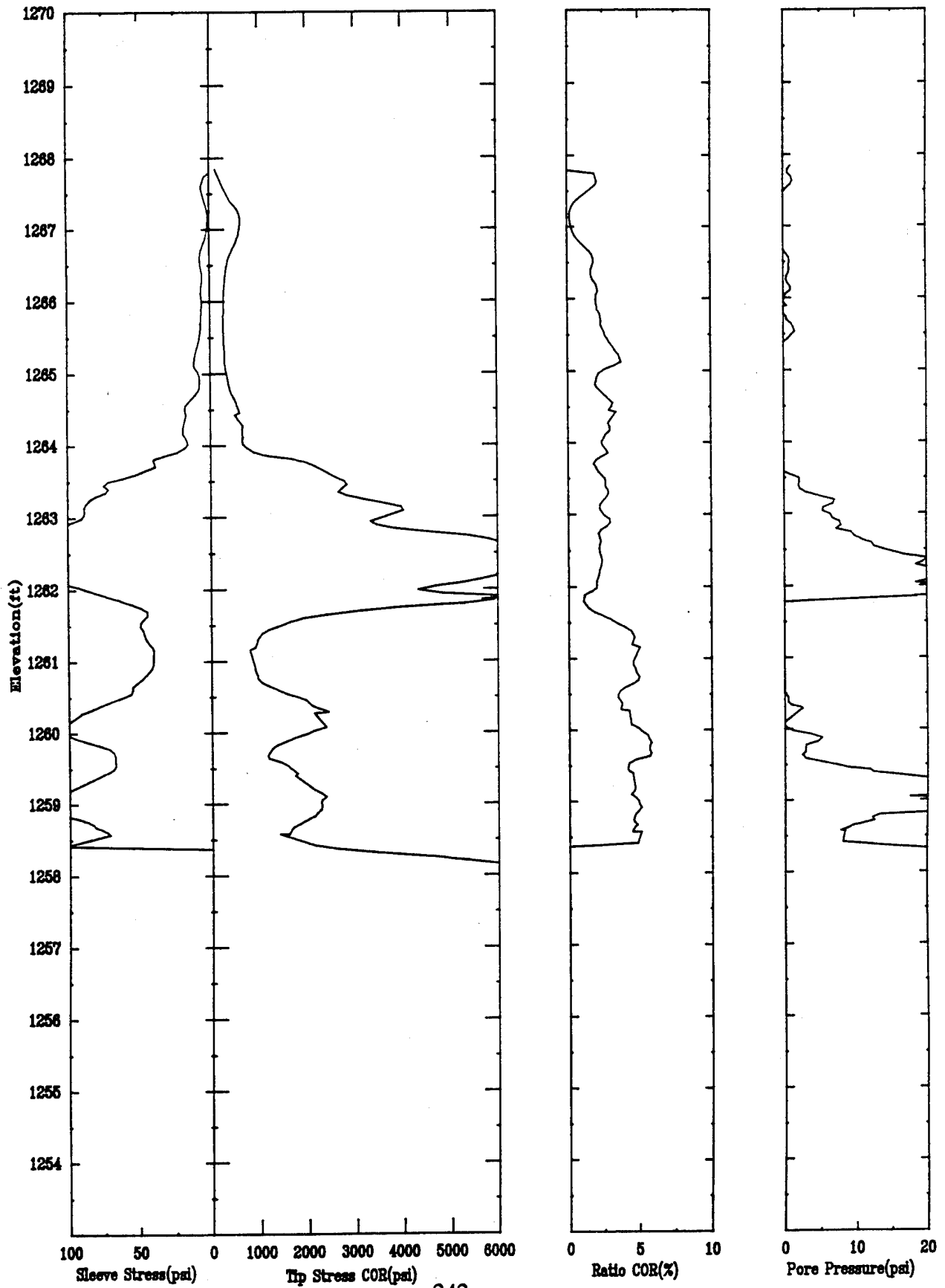
APPLIED RESEARCH ASSOCIATES, INC.

09/22/92

North 153956

East 2187380

Elevation 1268.0



BGA-04

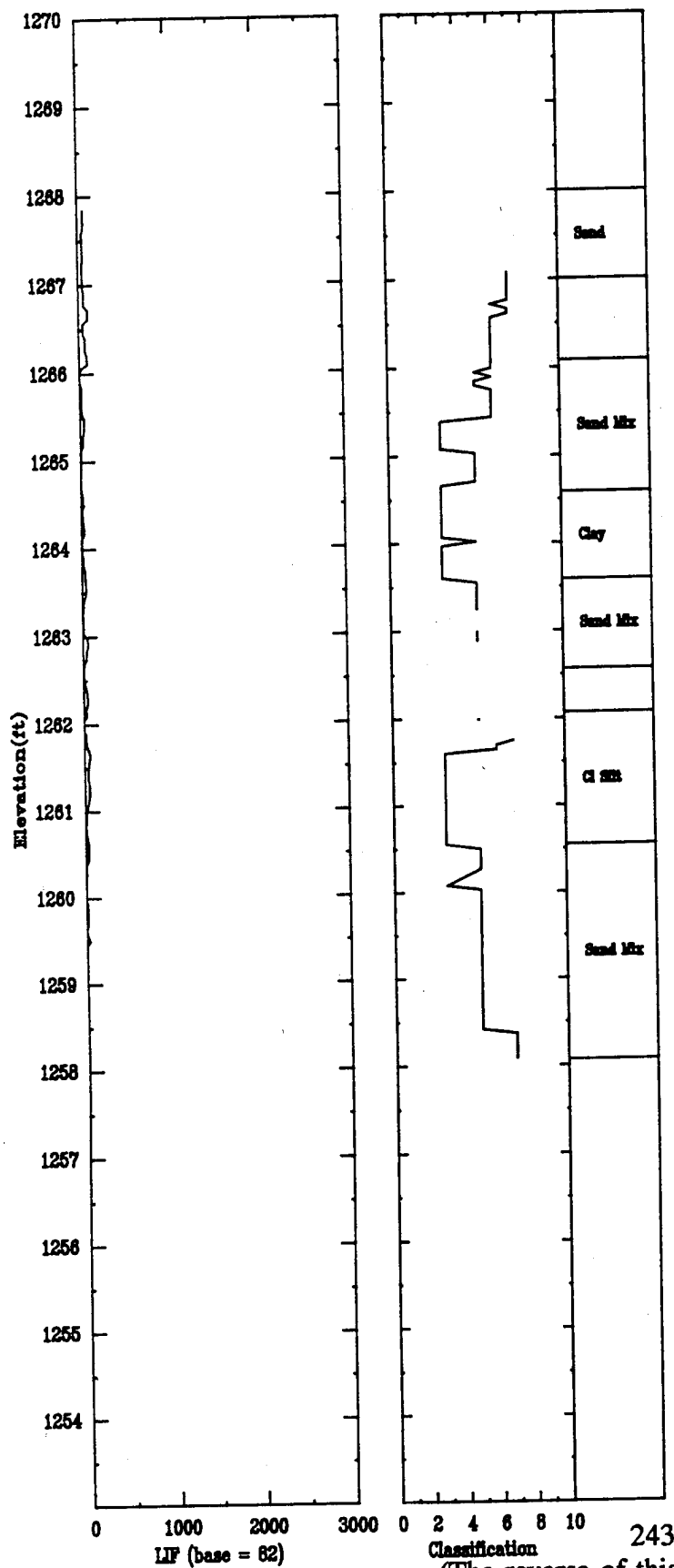
APPLIED RESEARCH ASSOCIATES, INC.

09/22/92

North 153956

East 2187380

Elevation 1268.0



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APPENDIX I

BORING LOGS FROM ALL SITES

APPLIED RESEARCH ASSOCIATES, INC.

[illegible]

REMARKS:

Warm & sunny weather.
Fill could be related to buried sewer line.
Slow drilling from 12 to 17'.
Sample SS-1 from 13 to 14'.
Water sample taken 9/18.

APPLIED RESEARCH ASSOCIATES, INC.

[illegible]

REMARKS:

9/17/92 16:30 Sample 12-14' 1 qt.
water sample 9/18

APPLIED RESEARCH ASSOCIATES, INC.

BORING LOG		BORING/WELL NO.: NTA-B04		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location:	
Project No.: 5735		Client: Air Force			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/16/92 (13:30)		Date End: 9/16/92 (15:00)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler, HSA				Surface Elevation (ft):	
Depth to Groundwater: 13.0 ft		11.5'		some product	
Date/Time: 9/16/92 18:00		9/18 AM		<0.05' thick	

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-2' 100%			Fill; sandy clay, mostly silt and clay, some sand	
					red to brown, firm; slightly moist, few gravel	
	2	2-7' 100%			Same as above to 6.5'.	
6.5					Silty clay; mostly clay, some silt, little sand;	
					olive changing to yellow with increasing depth	
	3	7-12' 100%		yes	Same as above to 11.5'.	
11.5					Silty fine sand; most fine sand	
					little silt, red strong hydrocarbon odor.	
	4	12-17' 20%			Little recovery of sample.	

REMARKS:

Hit pipe at 5 ft., abandoned metal. Moved 2 ft NNE for this hole.
 Approx. 2 ft from NTA-04
 Hard drilling at 11', not in exact location as NTA-04 CPT push
 Nearby hole indicates sandstone for portion at 19 to 23'
 Dan Hunt reports leak was near base of tank at this location
 Water sample 9/18

APPLIED RESEARCH ASSOCIATES, INC.

BORING LOG		BORING/WELL NO.: NTA-B05		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location:	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy Zevasky	
Date Start: 9/16/92 (11:15)		Date End: 9/16/92 (12:30)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler - 2 inch				Surface Elevation (ft):	
Depth to Groundwater:		12.6' BGS		11.3' some product	
Date/Time:		9/16/92 15:00		9/18/92 AM <0.05'	

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-2' 100%			Fill: Sandy Clay; mostly silt and clay with some sand, red, moist, mottled lt. brown/black/white rootlets	
	2	2-7' 70%			Same as above; very moist zone at 7'.	
	3	7-12' 20%			Same as above, but very moist at 8'	
8					Silty fine sand; very moist to wet	
					Loss on recovery ?, red	
	4	12-14 80%			Same as above (silty fine sand)	
14.5					Sandstone: Red silty sand	
					Cementation or gypsum	
					dense formation.	
17.0	5	14.5-17			End of boring.	

REMARKS:

Take sample at 13.0 - 14.0' NTA-B05-SS1 1 qt
 AW Pool leave augers in till 14:45, water enter to 12.6'
 after 15 min., permeable zone located above 17' with
 augers in water at 16.3 ft, not recharging quickly
 Water sample hot, 2 sets of duplicates for GC & GC/MS taken 9/18

APPLIED RESEARCH ASSOCIATES, INC.

[illegible]

REMARKS:

Product on auger from 14 to 17 ft
Sample from 12-17 is probably from 12-13 ft interval
Dan Hunt reports leak in tank near NTA-06 was at 10 ft on sidewall.
Water sample 9/18, soil sample 13-14'.

APPLIED RESEARCH ASSOCIATES, INC.

[illegible]

REMARKS:

Harder drilling at 11', similar to CPT refusal
Sample taken at 13-16'. Water sample 9/17

APPLIED RESEARCH ASSOCIATES, INC.

BORING LOG		BORING/WELL NO.: NTA-B08		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location:	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/16/92 (15:00)		Date End: 9/16/92 (16:40)		Logged by: JPI	
Driller Method/Rig Type:				Surface Elevation (ft):	
Depth to Groundwater: 12.5'		11.1			
Date/Time: 9/16/92 17:00		9/18 AM			

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-2' 100%			Fill: Sandy Clay, mostly clay and silt, some sand, red to brown, gypsum crystals in places	
	2	2-7' 95%			Same as above (fill), clay zone in silty sand zones in places	
6.5					Gray sandy clay to Silty Sand; 1' alternating layers, no petroleum odor. Some rootlets @ 6'.	
	3	7-12' 70%			Same as above to 11.5.	
11.5	4	12-17' 85%		HC	Weathered sandstone; mostly fine sand, some silt. Strong petroleum odor at 13' to 15'. Mostly fine sand, few silt, lenses of sandy silt to clay, red, moist to very moist	

REMARKS:

Sample soil @ 13-15'.
Water sample 9/16.

APPLIED RESEARCH ASSOCIATES, INC.

[illegible]

REMARKS:

Soil sample SS-1 @ 13-15'.
Water sample 9/18.

APPLIED RESEARCH ASSOCIATES, INC.

[illegible]

REMARKS:

Soil sample @ 13-14'.
Water sample 9/18.

APPLIED RESEARCH ASSOCIATES, INC.

BORING LOG		BORING/WELL NO.: NTA-B11		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location:	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/18/92 (10:20)		Date End: 9/18/92 (11:20)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater:		13.0'	12.7'		
Date/Time:		9/18 AM	9/18 13:45		

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
					0.8 Concrete	
0	1	0-2' 100%			Fill: Silty Sand; mostly sand fine to coarse,	
					trace gravel, little silt, light brown, moist	
1.8	2	2-7' 100%			Fill: Silty Clay; dark gray to olive, moist	
6.0					Fill: sandy clay, light brown to yellow,	
					mostly clay and silt, little sand and gravel,	
	3	7-12' 60%			moist	
8.0					Sandy Clay; mostly silt and clay, little sand	
					moist, red brown	
11.0		12-17' 30%			Weathered Sandstone: mostly fine sand,	
					little fines, stratified sand and clay	
					horizons, red, moist to very moist	

REMARKS:

Sample soil SS-1 @ 13-14'.
Duplicate water samples taken 9/18

APPLIED RESEARCH ASSOCIATES, INC.

BORING LOG		BORING/WELL NO.: FPA-B01		Page 1 of 2	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location:	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy Zavasky	
Date Start 9/23/92 (8 :15 am)		Date End 9/23/92 (11 : 20)		Logged by: JPI	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater:				20.8 (27.7' TD) 12.3 (23.5' TD)	
Date/Time:				9/23 17:40 9/24 8:20	

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-2.5 100%	?		Fill: Sandy clay; mostly silt and clay	
					Some sand and gravel, slightly moist	
					brown-red.	
	2	2.5-7.5 100%	no		Fill: as above	
3					Silty clay: very plastic, brown	
					slightly moist, gradual at change to red color at 5.0	
					Some sand and gravel included in clay at 6.5 to 7.5 - Mineralization in places	
	3	7.5-12.5 100%	no		Same as above with more sandy texture	
					Mineralized sections to 11 ft. More blocky at	
					11 to 12.5 feet	
	4	12.5-17.5 90%			Same as above to 12.5	
13					Sandy clay. Mostly clay and silt	
					little sand, slightly moist, red	
					fissile from 13 to 15' - blocky 15 to 17.5	

REMARKS:

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BORING LOG		BORING/WELL NO.: FPA-B01		Page 2 of 2	
Project and Location AFSCAPS, Tinker AFB, OK				Boring Location:	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy Zavasky	
Date Start (: _m)		Date End (: _m)		Logged by:	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater:					
Date/Time:					

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
	5	17.5-22.5 100%		no	Weathered Siltstone to Shale	
					mostly clay and silt, some sand	
					continuous core with little fracturing	
					very hard, red	
	6	22.5-27.5 100%		no	same as above,	
					sandstone lens at 25' appears crystalline due to	
					cementation, other occasional lens below 25'	
	7	27.5-32.5 100%		no	Same as above	
					with sandstone lenses, some	
					silt lenses (mottled zone appearance) at 31	
					to 32' with white mineral (gypsum)	

REMARKS:

10:00 Auger broke in hole at 27.5 to 32.5', upon withdrawal, fishing tool used to pull out auger sampled SS-1 (dup.) @1' SS-2 @ 5', SS-3 @ 10', SS-4 @ 15'

APPLIED RESEARCH ASSOCIATES, INC.

BORING LOG		BORING/WELL NO.: FPA-B31		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB				Boring Location: at Flag GG	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start 9/23/92 (11:40 am)		Date End 9/23/92 (13:30 pm)		Logged by:	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater:		20.7' 20.8 TD HC ODOR		18.2 20.0 TD HC ODOR	
Date/Time:		9/23 17:25		9/24 9:30	

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-2.25 100%	HC	yes	FILL: Silty sand, moist, red.	
					Mostly fine to medium sand, some silt, few clay.	
					Product HC inc. content with depth	
	2	2.25-7.25 100%		yes	Same as above to 3.5 ft.	
3.5					Silty clay; mostly silt and clay, few sand, moist	
					mottled, dk. brown	
7.25	3	7.25-12.25 100%		yes	Sandy clay; mostly silt and clay, some sand, somewhat fissile, moist red.	
					Mineralization at 11 ft, gypsum	
					microcrystalline replacement	
	3	12.25-17.25 100%		somewhat	Same as above but more blocky	
					Assume weathered bedrock vs. soil @ 1.5'	
	4	17.25-22.25 100%		no	Weathered shale/siltstone sequence	

REMARKS:

Sample SS 1A @ 1', SS-1 2.5-3.5', SS-2 @6', SS-3 8-9', SS-4 @ 11', SS-4A @ 13', SS-5 @ 16', SS-6 @ 19'
LIF hot zones from 2.75 - 3.75 and 7.5 - 9.25

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BORING LOG		BORING/WELL NO.: FPA-B32		Page 1 of 2	
Project and Location: AFSCAPS, Tinker AFB				Boring Location: S-SW of concret pad in gravel drive	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy Zavasky	
Date Start: 9/22/92 (15:20pm)		Date End: 9/22/92 (17:20pm)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater:		23.0' BGS (27' TD)		19.0'	18.0
					12.3 (22.7 TD) slight HC ODOR
Date/Time:		9/23 8:00 a		9/23 14:00	9/23 17:00
					9/24 9:20 a

Depth (ft)	Sample				Soil Description	Graph/NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-2 100%			Fill: sandy clay with gravel. Poorly sorted, sand and gravel in clay matrix	
			HC	yes	red, slightly moist to moist	
					gravely sand layer at 1-1.2 ft BG	
	2	2-7 30%		some	Same as above but small recovery	
6.2					Sandy clay: mostly clay and silt, little sand	
					olive brown, slightly moist	
	3	7-12 100%		trace	Same, slightly moist, olive to 8 ft,	
					8-9 mottled, red with black organics found in	
					horizontal fractures	
10.00					Gravelly clay; mineralized layer possible	
					gypsum infilling pores	
12	4	12-17 90%		trace	Sand clay (weathered shale)	
					very fissile, red slightly moist	
					increasing silt and sand with depth	

REMARKS:

Suspect loss of core in sample 2 occurs at top of case

Hard drilling at 15'

Sampled SS-1 @ 1', SS-2 @ 6', SS-3 @ 10', SS-4 @ 14', SS-5 @ 17-22', SS-6 @ 22-27', SS-7 @ 30'.

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[illegible]

REMARKS:

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BORING LOG		BORING/WELL NO.: FPA-B33		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB				Boring Location: at mark BB W of pad10 ft	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy Zavasky	
Date Start: 9/23/92 (14:30)		Date End: 9/23/92 (15:44)		Logged by: JPJ	
Driller Method/Rig Type: CME continuous sampler				Surface Elevation (ft):	
Depth to Groundwater:				dry (18.7TD) 16.1 18.4' TD	
Date/Time:		9/23 17:40		9/24 9:00	

Depth	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-2.25 100%		yes	Fill: sandy clay; mostly clay and silt, some sand, slightly moist	
	2	2.25-7.25 80%		2-7 fuel odor	Same as above	
3.0					Silty clay; mostly silt and clay little sand; dk. brown to olive brown at 3.0 changing to dk. red at 7 ft.	
	3	7.25-12.25 85%			Weathered shale to siltstone -transitional from residual silty clay soil. Remineralized 0.2' layer at 10 ft - (white microcrystalline material - gypsum), red, moist	
	4	12.25-17.25 100%			Same as above weathered sandstone - fine sand matrix very hard	
16.0						
18.0	5	17.25-22.25 20%			weathered shale to siltstone sequence, moist, red	

REMARKS:

LIF hot zones at 1.25-2.25, 9.5-10.25, 11.75-13.75

Sampled SS-1 @ 1.25', SS-2 @ 3.5', SS-3 @ 7-8', SS-4 @ 9-10', SS-5 @ 13', SS-6 17-22'

SS-3 used for TCLP

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BORING LOG		BORING/WELL NO.: FPA-B41		Page 1 of 2	
Project and Location: AFSCAPS, Tinker AFB				Boring Location: d.g. of USTS	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy Zavasky	
Date Start: 9/22/92 (08:30)		Date End: 9/22/92 (10:30)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler HSA				Surface Elevation (ft):	
Depth to Groundwater:		11.0' BGS	6.6' BGS (13.9 TD)	6.4' 11.4' TD	HC ODOR
Date/Time:		8:00 9/23	9/23 16:50	9/24/92 10:00	

Depth	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-2.5 100%			Fill: Gravel - fill for road	
					coarse to fine gravel, little sand	
					and fines white	
0.5					Fill: sandy clay; mostly fines little	
					sand, few gravel, red, slightly moist.	
	2	2.5-7.5 100%		high HC	Same as above to 5, asphaltic	
				@ 03.5-4.5	zone at 3.5. HC concentrated between	
					3.5 - 4.5 in lower fill (? observed)	
5.0					Clay: mostly clay, some silt	
					dk. olive, slightly moist, trace HC odor	
10.5	3	7.5-12.5' 100%			Clay: mostly clay little silt, very firm, red brown,	
					slightly moist, trace HC odor	
				high HC	Silty clay with silt lenses; clay has	
				@ 10.5	little silt red, moist. Silt lenses at 10.5	
					and 11.5. @ 10.5 show silt with brown clay	

REMARKS:

Ponded water located 7' E of site, pond 40' x 30' x 1.5' deep.

Sample SS-1 @ 4-5', SS-2 @ 10-11', SS-3 @ 14-15', SS-4 @ 17.5-22.5, SS-5 @ 22.5-27.5.

LIF high from 2.2 to 5.5 and 10-14'.

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BORING LOG		BORING/WELL NO.: FPA-B41		Page 2 of 2	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location:	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: (: m)		Date End: (: m)		Logged by: JPJ	
Driller Method/Rig Type:				Surface Elevation (ft):	
Depth to Groundwater:					
Date/Time:					

Depth	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
	4	12.5-17.5 85 %			Silty clay; mostly clay, some silt,	
					slightly moist, red, highly	
					fissile in horizontal due to coring.	
					Harder drilling at 15 ft - more weathered	
					shale/sandstone	
	5	17.5-22.5 45 %			Weathered shale/sandstone sequence;	
					moist to very moist at 21.5	
	6	22.5-27.5 45 %			Same as above - shale over sandstone	
					sandstone - fine sand, very hard	
					22-24 SS 24-27 SL by	
					drilling late.	
					Pull out auger, hole filled to 24.5 with soil	
					no measurable water	

REMARKS:

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BORING LOG		BORING/WELL NO.: FPA-B45		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location: 20' SW of fuel purge ASTs	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy Zavasky	
Date Start: 9/22/92 (10:30)		Date End: 9/22/92 (12:15)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler HSA				Surface Elevation (ft):	
Depth to Groundwater:		22.9' muddy 25.2' TD		23.6 SC low (25' TD)	
Date/Time:		9/23 17:15		9/24 8:45	

Depth	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-2.5 100%			Sandy Clay: Mostly clay, few silt and sand, brown & red with roots to 1.5, brown below 1.5', very plastic	
	2	2.5-7.5 80%			Same as above (Sandy Clay); brown to 5-6 ft plastic, red - below 5-6 ft slightly mottled with organic partings	
	3	7.5-12.5 100%			Sandy clay (weathered shale); mostly clay with increasing silt and sand content with depth, 2-inch thick gravelly zone at 8.5, very moist at 10 ft, red	
	4	12.5-17.5 100%			Weathered shale; very fissile moist, red, sandstone at 17.5 hard drilling at 17 ft	

REMARKS:

Hole filled in with soil to 13.5 ft, redrilled to 27.5 ft @ 13:30, finish @ 15:00 on 9/22/92

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BORING LOG		BORING/WELL NO.: FTA-B01		Page 1 of 2	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location: at flag 4	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/26/92 (16:15)		Date End: 9/26/92 (17:15)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater: 14.2'		10.8'			
Date/Time: 9/26/92 18:00		9/28/92 11:42			

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-2' 100%	trace		Fill; Sandy Gravel: mostly fine to coarse	
					coarse gravel, angular, some sand and fines,	
					white and gray, slightly moist.	
0.7			HC yes		Fill: Sand and Clay: mostly clay and silt,	
					little sand and gravel, red brown, plastic, moist.	
	2	2-7' 80%	HC yes		Same as above, metal parts and wires from 2.5'	
					to 3.5'.	
3.5			HC yes		Silty Sand: mostly fine to coarse sand,	
					some silt, trace clay, black gray.	
					Possible old ground surface (buried).	
4.5			HC yes		Sandy Clay; mostly silt and clay,	
					some sand, brown, plastic, moist.	
	3	7-12' 100%			Same as above, grading to weathered	
					shale, red, with increased abundance of	
					subhorizontal parting increasing with depth.	
					Remineralization at 11.0. Gravel size precipitate	
					- gypsum? chert? CaCO ₃ ?	

REMARKS:

Windy, sunny 70-80°
 LIF above bg 0-2.25, 2.25 and below hot, 3.25-4.25 hottest
 Sample water 10:00 9/26
 WTM's at 2.45' BGS and 3.45' BGS

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[illegible]

REMARKS:

Sheen on water in hole.

Total depth = 14.6 after pull out.

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[illegible]

REMARKS:

SS1 - 1-2'

SS2 - 9-10'

AW Pool grouting B01, B04, 12:30, water level not stabilized due to slow response of formation.

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BORING LOG		BORING/WELL NO.: WTP-B01		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location: Flag 2	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy Zavasky	
Date Start: 9/24/92 (13:15)		Date End: 9/24/92 (14:20)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater:(16.1 TD)		16.3'	Moist TD 16.4'	TD = Total Depth	
Date/Time: 9/24 14:20		9/25/92 10:20	9/25/92 9:14		

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0					Asphalt Pavement	
0.5	1	0.5-2.5 100%		no	Fill: Sand and Gravel: f to c sand	
					with gravel, base for asphalt	
1.2					Sandy Clay: mostly clay and silt,	
					some sand, slightly moist, brittle	
					red with brown, black, faint mottle	
	2	2.5 - 7.5' 50%		no	Same as above (with some horizontal banding	
					of olive brown and red brown)	
5.0					Silty Sand: mostly fine sand, little silt,	
					few clay, black, moist changing to brown	
					with depth.	
8.0	3	7.5-12.5' 50%		no	Weathered Sandstone: mostly fine sand,	
					some silt, moist, very dense, red	
	4	12.5-17.5' 100%		no	Same as above; some mottling, very moist	
					to wet at 15 ft, more loose in saturated zone.	

REMARKS:

Drill to 17.5, after augers are pull out, hole at 16.1 total depth
 SS-1 16'
 No water sample due to small volume of water in hole

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BORING LOG		BORING/WELL NO.: WTP-B02		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location: Flag 2	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy Zelasky	
Date Start: 9/24/92 (14:30)		Date End: 9/24/92 (15:10)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater: 16' TD		15.4'		15.5' (158'TD)	
Date/Time: 9/24/92 16:00		9/25/92 10:20		9/26/92 9:16	

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0					Asphaltic Pavement	
0.5	1	0.5-2.5 100%		no	Fill: Sand and Gravel, f to c sand	
					Angular f to c gravel. Base for pave	
1.2					Sandy clay: mostly silt and clay,	
					little sand, firm moist, red with	
					black mottling common.	
	2	2.5-7.5 100%		no	Same as above to 5.5'.	
5.5					Silty Fine Sand: mostly fine sand, some silt	
					few clay. Dk. gray at 5.5' grading to	
					brown at 6.5', moist, loose.	
	3	7.5-12.5 100%		no	Same as above to 8.0	
8.0					Sandy Clay: mostly silt and clay, little sand,	
					brown, moist, slightly plastic.	
10.0					Silty fine sand; mostly fine sand, some	
					silt, moist, brown.	
12.0	4	12.5-17.5 100%		no	Sandy Clay: brown, moist,	
15.0					silty fine sand, brown, moist to wet	

REMARKS:

Soil sample at 16' and water sample on 9/26.

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BORING LOG		BORING/WELL NO.: WTP-B03		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location: Survey Mark 3	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/24/92 (15:10)		Date End: 9/24/92 (16:00)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater: 14.6'		14.8' 16.1'TD			
Date/Time: 9/25/92 10:16		9/26/92 9:36			

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0					Asphalt Pavement	
0.5	1	0.5-2.5 100%			Fill: Sand and Gravel, f to c sand, angular gravel, bride franments, brown, slightly moist.	
1.8					Sandy Clay: mostly silt and clay, little sand, very firm, moist, red with black mottling.	
	2	2.5-7.5 100%			Same as above.	
5.5					Silty Fine Sand: mostly fine sand, some silt few clay, moist, med. dense dk. gray at 5.5' grading to brown at 7.0'.	
9.5		7.5-12.5 100%			Silty Clay: mostly silt and clay, few sand, brown, moist, plastic.	
11.5					Silty fine sand: mostly fine sand, little silt, few clay, moist, brown.	
		12.5-17.5 100%			Same as above.	
13.5					Silty clay: mostly silt and clay, brown, very moist.	
16.0					Silty fine Sand: mostly fine sand, little silt very moist to wet.	

REMARKS:

Soil sample SS-1 at 16', water sampled on 9/26.

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BORING LOG		BORING/WELL NO.: WTP-B04		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location: Survey Mark 4	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/25/92 (8:10)		Date End: 9/25/92 (9:00)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater:		13.3'(15.7'TD)		13.4' (15.4 TD)	
Date/Time:		9/25/92 11:30		9/26 10:25	

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0					Asphalt Pavement	
0.3	1	0.3-2.3' 100%		no	Fill: Sandy Clay, some silt and clay, little sand and gravel, asphalt pieces scattered, red to brown, slightly moist.	
	2	2.3-7.3' 60%		no	Same as above to 6.0'? (poor recovery).	
6.0	3	7.3-12.3' 100%			Silty fine sand; mostly fine sand, some silt and clay, brown to olive, moist	
9.5					Silty clay; mostly clay and silt, little sand, brown to red, moist, very stiff.	
	4	12.3-17.3 100%		no	Same as above to 15'.	
15.0					Silty Fine Sand: mostly fine sand, some silt and clay, red, very moist.	

REMARKS:

Soil sample SS-1 at 16', water sample on 9/26.

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BORING LOG		BORING/WELL NO.: WTP-B05		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location: Survey mark 5	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/25/92 (9:00)		Date End: 9/25/92 (9:50)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater:		11.8 (12.6'TD)		12.5' (12.6')	
Date/Time:		9/25 11:30		9/26 10:40	

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0					Asphaltic Pavement	
0.5	1	0.5-2.5 100%			Fill: Sandy Clay; mostly silt and clay, some sand and angular gravel, few asphalt fragments, brown to red, moist.	
	2	2.5-7.5 100%			Same as above to 5.0.	
5.0					Sandy Clay: mostly clay and silt, some fine sand, moist, red brown.	
	3	7.5-12.5' 100%			Same as above to 10.5.	
10.5					Silty fine Sand: mostly fine sand, some silt and clay, moist, red with black mottling.	
13.0		12.5-14.0' 100%			Weathered Sandstone. Refusal at 14.0'.	

REMARKS:

Refusal at 14 ft.

Soil sample Ss-1 at 14', water sampled on 9/26.

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BORING LOG		BORING/WELL NO.: WTP-B06		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location: Survey mark 06	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/25/92 (9:50)		Date End: 9/25/92 (11:00)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater:		11.7 (14.9'TD)		11.8'	
Date/Time:		9/25 11:30		9/26 11:00	

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0					Concrete Pavement	
0.8	1	0.8-2.8 100%			Fill: Clayey Sand; f to c sand with lenses of sandy clay, red and gray	
		2.8-7.8 80%			Same.	
3.0	2				Silty fine Sand: mostly fine sand, some silt and clay, dk. brown at 3' to brown below 4', moist.	
4.5					Sandy Clay: mostly silt and clay, some sand, brown with black mottling common, moist.	
	3	7.8-12.8 80%			Same as above.	
10.0					Silty fine sand, mostly fine sand, some clay and silt, red with common black mottling, more sandy with inc. depth.	
	4	12.8-17.8' 40%			Same as above but banded with yellow and purple zones, some endurated sand lenses (weathered sandstone).	

REMARKS:

Soil sample Ss-1 from 13-17', water sample 9/26.
Large catch basin located 20' S of B06 (dry).

APPLIED RESEARCH ASSOCIATES, INC.

BORING LOG		BORING/WELL NO.: WTP-B07		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location: Survey mark B07	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/25/92 (11:30)		Date End: 9/25/92 (12:30)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater: 13.2' (14'TD)		13.3'			
Date/Time: 9/25/92 15:30		9/26 11:20			

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0					Concrete Pavement	
0.8		0.8-2.8 90%			Fill: Sand and Sandy Clay; with gravel	
					sand gray base from 0.8 to 1.5	
2.8		2.8-7.8 100%			Silty fine Sand: mostly fine sand, little	
					silt and clay, moist, some perched water	
					at 7 ft, dk. gray at 2.8 to red brown at 7'.	
6.5					Sandy Clay; mostly silt and clay, little sand,	
					moist, stiff, red with black mottling.	
8.0		7.8-12.8' 85%			Silty Fine Sand: mostly fine sand,	
					some silt and clay, red, moist.	
11.0					Sand (weathered sandstone);	
					mostly medium to coarse sand, bedded.	
					3 to 1 in thick, moist to wet,	
		12.8-17.8' 80%			Same as above: lt. red brown with yellow and	
					purple mottling from 15 ft.	

REMARKS:

Soil sample SS-1 at 16', water sample taken on 9/26.

APPLIED RESEARCH ASSOCIATES, INC.

BORING LOG		BORING/WELL NO.: WTP-B08		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location: Survey mark 9	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/25/92 (13:40)		Date End: 9/25/92 (14:40)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater: 17.7'(21'TD)		17.8' (19.8'TD)			
Date/Time: 9/25/92 15:53		9/26 11:30			

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0					Asphalt Pavement	
0.4	1	0.4-2.4 100%			Fill: Clay Sand mixture, with gravel, red, moist.	
	2	2.4-7.4' 100%		no	Same as above.	
3.5					Silty fine sand: mostly fine sand, some silt and clay, moist, dk. gray at 3.5' to light brown.	
6.5					Sandy Clay: mostly clay and silt, little sand, lt. brown, moist.	
	3	7.4-12.4' 100%		no	Same as above.	
	4	12.4-17.4' 100%		no	Same as above grading to red with black mottling (occasional).	
	5	17.4-22.4 100%		no	Same as above, occasional fine sand lenses, very moist at 18 ft.	

REMARKS:

Soil sample SS-1 at 16', water sample taken on 9/20/92.

Hole drilled deeper than other WTP sites to ensure sater sample is taken.

APPLIED RESEARCH ASSOCIATES, INC.

BORING LOG		BORING/WELL NO.: OSC-B01		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location: ARA flag 14	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/25/92 (15:40)		Date End: 9/25/92 (16:40)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater:		N/A			
Date/Time:					

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-2' 100%		no	Topsoil	
0.2					Fill; Sandy Clay: moslty silt and clay,	
					some sand, occasional gravel subrounded	
					to angular, red, moist.	
	2	2.0-7.0' 100%		no	Same as above.	
4.5					Sandy clay; mostly silt and clay,	
					brown at 4.5 to orange at 6.0, moist.	
	3	7-12.0 100%		no	Same as above, red, moist,	
					occasional black mottle.	
	4	12-17.0 100%		no	Same as above, red moist, more	
					common black mottling.	

REMARKS:

Surface elevation 9' above pond in outfall
 Water level not stabilized due to grouting
 (No water sample requested)

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[illegible]

REMARKS:

No free water observed, holes grouted up
Surface elevation 4 ft above 3rd pond from East Dr.
and 9 ft above 4th pond from East Dr.

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BORING LOG		BORING/WELL NO.: OFB-B01		Page 1 of 2	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location: N-NW of Breeden's 10 ft N of septic tank	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/28/92 (15:45)		Date End: 9/28/92 (17:15)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater: 14.0		6.0'			
Date/Time: 9/28/92 18:20		9/29/92 10:00			

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-3 100%		no	Top Soil and Organic Matter	
0.2					Sandy Clay; mostly silt and clay, little sand, moist, plastic, dk. brown.	
	2	3.8' 100%		no	Same as above, gradual change to red brown at 5.0', moist.	
6.5				no	Silty Fine Sand: mostly fine to medium sand, some silt and clay, very moist, red orange with occasional black mottling at 7.5 ft.	
9.0	3	8-13' 50%		no	Clayey Silt: mostly silt, some clay, little fine sand, very moist to wet, red orange with orange black and white mottling (white = silt).	
10.5					Sandstone lens, some remineralization	
	4	13-18' 80%		no	Weathered sandstone/shale sequence, very dense clay-silt sand mix, stratified with thin white silt bands at 16-17'.	

REMARKS:

Top of septic tank 1' BGS, 4 ft diameter concrete tank
Soil samples at 6 - 7', 9 -10', 16 - 17', and 21 -22'.

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[illegible]

REMARKS:

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BORING LOG		BORING/WELL NO.: OFB-B02		Page 1 of 1	
Project and Location: AFSCAPS, Tinker AFB, OK				Boring Location:	
Project No.: 5735		Client: USAF			
Contractor:		Driller Contractor: AW Pool		Driller: Andy	
Date Start: 9/28/92 (17:15)		Date End: 9/28/92 (18:50)		Logged by: JPJ	
Driller Method/Rig Type: CME Continuous Sampler				Surface Elevation (ft):	
Depth to Groundwater:		6.0'			
Date/Time:		9/29/92 10:00			

Depth (ft)	Sample				Soil Description	Graph/ NOTE
	No.	Depth/Rec	Blow/6"	Vapor		
0	1	0-3' 100%		no	Topsoil and Organic Matter	
0.2					Sandy Clay; mostly silt and clay, some sand, plastic, moist, brown.	
	2	3-8' 100%		no	Same as above but more red.	
6.0					Silty Fine Sand; mostly fine to medium sand, some silt and clay, very moist, red with occasional black mottles from 7.0'	
8.0	3	8-13' 100%		no	Sandy Clay: mineralized layer is sandy clay from 8.5 to 9.0 above silty fine sand (white).	
9.0					Silty Fine Sand: mostly fine sand, some silt and clay, red, moist.	
12.0					Sandy Clay (see above).	
	4	13-18 100%		no	Same as above, moist, fissile sandy stringers located at 16' and 17', very silty at 17-18'.	
	5	18-23' 100%		no	Same as above.	
19					Silty Fine Sand and Sandstone: red, moist alternating dense and very dense layers, occasional white silt stringers, mostly fine sand, some silt, little clay.	

REMARKS:

Sample soil at 7-8', 11-12', 16.5-17.5', and 22-23'.

APPENDIX J

WTM PLOT FROM ALL LIF-CPT SITES

Tinker Air Force Base
Wavelength-Time-Matrices

LOCATION	FVD FILE	3DE FILE	DEPTH (ft)
1A	BKGDSIT1	BKGDSIT2	BOTTOM
1B	BKGDSIT3	BKGDSIT4	GUIDE TUBE
1C	NTA-04M	NTA-3D4	0 (GRASS)
1D	NTA-04M	NTA-3D4A	12.77
2A	NTA-04M	NTA-3D4B	12.75
2B	NTA-04M	NTA-3D4C	14.95
2C	NTA-04M	NTA-3D4D	19.39
2D	NTA-05A	NTA-3D5	12.75
3A	NTA-06M	NTA-3D6A	12.89
3B	NTA-06M	NTA-3D6D	16.75
3C	FPA-04A	FPA-3D4	14.42
3D	FPA-03A	FPA-3D3	6.02
4A	FPA-03A	FPA-3D3A	12.25
4B	FPA-06	FPA-06D	18.75
4C	FPA-08	FPA-3D08	17.75
4D	FPA-09	FPA-3D09	17.64
5A	FPA-10	FPA-3D10	15.77
5B	FPA-11A	FPA-3D11	0.91
5C	FPA-11A	FPA-3D11D	8.32
5D	FPA-13	FPA-3D13	10.64
6A	FPA-15	FP3D15	1.63
6B	FPA-17	FP3D17	8.88
6C	FPA-18	FP3D18	7.40
6D	FPA-18	FP3D18A	5.72
7A	FPA-20	FP3D20	9.60
7B	FPA-21	FP3D21	9.05
7C	FPA-30	FP3D30	2.38
7D	FPA-31	FP3D31	2.51
8A	FPA-32	FP3D32	11.91
8B	FPA-33	FP3D33	2.05
8C	FPA-33	FP3D33A	10.08
8D	FPA-40	FPD40	3.96
9A	FPA-41	FP3D41	2.66
9B	FPA-41	FP3D41A	5.43

9C	FPA-49	FP3D49	8.76
9D	FPA-49	FP3D49A	9.90
10A	FTA-01	FT3D01A	3.47
10B	FTA-03	FT3D03A	4.18
10C	FPA-51	FPE3D1A	8.85
10D	FPA-52	FPE3D2A	8.75
11A	FPA-53	FPE3D3A	8.81
11B	FPA-53	FPE3D3B	13.7
11C	FPA-54	FPE3D4A	8.75
11D	FPA-55	FPE3D5A	10.24
12A	FPA-55	FPE3D5B	14.00
12B	LF2-01B	LF23DA	6.05
12C	LF2-02	LF23D02A	7.05
12D	LF2-03	LF23D04A	8.56
13A	LF2-05	LF23D05A	8.62
13B	LF2-06	LF23D06A	8.19
13C	LF2-07	LF23D07A	11.94

Tinker Air Force Base
Wavelength-Time-Matrices

FVD FILE	3DE FILE	DEPTH (ft)	LOCATION
BKGDSIT1	BKGDSIT2	BOTTOM	1A
BKGDSIT3	BKGDSIT4	GUIDE TUBE	1B
FPA-03A	FPA-3D3	6.02	3D
FPA-03A	FPA-3D3A	12.25	4A
FPA-04A	FPA-3D4	14.42	3C
FPA-06	FPA-06D	18.75	4B
FPA-08	FPA-3D08	17.75	4C
FPA-09	FPA-3D09	17.64	4D
FPA-10	FPA-3D10	15.77	5A
FPA-11A	FPA-3D11	0.91	5B
FPA-11A	FPA-3D11D	8.32	5C
FPA-13	FPA-3D13	10.64	5D
FPA-15	FP3D15	1.63	6A
FPA-17	FP3D17	8.88	6B
FPA-18	FP3D18	7.40	6C
FPA-18	FP3D18A	5.72	6D
FPA-20	FP3D20	9.60	7A
FPA-21	FP3D21	9.05	7B
FPA-30	FP3D30	2.38	7C
FPA-31	FP3D31	2.51	7D
FPA-32	FP3D32	11.91	8A
FPA-33	FP3D33	2.05	8B
FPA-33	FP3D33A	10.08	8C
FPA-40	FPD40	3.96	8D
FPA-41	FP3D41	2.66	9A
FPA-41	FP3D41A	5.43	9B
FPA-49	FP3D49	8.76	9C
FPA-49	FP3D49A	9.90	9D
FPA-51	FPE3D1A	8.85	10C
FPA-52	FPE3D2A	8.75	10D
FPA-53	FPE3D3A	8.81	11A
FPA-53	FPE3D3B	13.7	11B
FPA-54	FPE3D4A	8.75	11C
FPA-55	FPE3D5A	10.24	11D

FPA-55	FPE3D5B	14.00	12A
FTA-01	FT3D01A	3.47	10A
FTA-03	FT3D03A	4.18	10B
LF2-01B	LF23DA	6.05	12B
LF2-02	LF23D02A	7.05	12C
LF2-03	LF23D04A	8.56	12D
LF2-05	LF23D05A	8.62	13A
LF2-06	LF23D06A	8.19	13B
LF2-07	LF23D07A	11.94	13C
NTA-04M	NTA-3D4	0 (GRASS)	1C
NTA-04M	NTA-3D4A	12.77	1D
NTA-04M	NTA-3D4B	12.75	2A
NTA-04M	NTA-3D4C	14.95	2B
NTA-04M	NTA-3D4D	19.39	2C
NTA-05A	NTA-3D5	12.75	2D
NTA-06M	NTA-3D6A	12.89	3A
NTA-06M	NTA-3D6D	16.75	3B

